OCTOBER
1948

American Foundryman

THE
FOUNDRYMEN'S
Own
MAGAZINE

from **100 tons** *to* **25 pounds** *capacity*

MOORE RAPID

Lectromelt

FURNACES

famous the world over for speed, economy, dependability and flexibility in the melting and refining of iron, steel, nickel and copper.

Manufactured in

CANADA	Lectromelt Furnaces of Canada, Ltd., Toronto 2
ENGLAND, SWEDEN, AUSTRALIA	Birlec, Ltd., Birmingham, England
FRANCE	Stein et Roubaix, Paris
BELGIUM	S. A. Belge Stein et Roubaix, Bressoux-Liege
SPAIN	General Electric Espanola, Bilbao
ITALY	Forni Stein, Genoa

PITTSBURGH LECTROMELT FURNACE CORP.

PITTSBURGH 30, PENNSYLVANIA

NEED "NEW BLOOD"?

First Set Your House in Order

UPON VISITING several foundries in Europe recently, I find their problem is very much the same as our own—mainly, an insufficient number of skilled molders. The British and French foundry societies are extremely anxious to cooperate with the American Foundrymen's Society to improve this condition and the industry in general.

Manufacturers of metal products are at last realizing the importance of the foundry to their finished product, but many engineering plants in the past looked on the foundry as a stepchild and top management simply ignored the foundry. Therefore, in any improvements to be made in the works, the foundry was the last to be considered. As a result we are up against a problem created by defective and inferior castings made in bygone days. This situation has caused design engineers to specify materials processed in other ways in place of castings.

The metallurgist has greatly improved the physical and chemical qualities of cast metals. Modern equipment has reduced much of the manual labor in foundries. Regardless of these improvements it is still necessary to make a good mold to create a good casting.

We have distributed books stating that "The Foundry Is a GOOD Place To Work," and yet today we are extremely short of first class molders in the jobbing foundry. It seems that young men with the necessary physical and mental ability are not willing to learn the molder's trade. A questionnaire, sent to a number of students who had visited several foundries asked what they thought of foundry work. One of them replied that he would not take up foundry work because it was too hard, the place was dirty, and one had to know too much—for unskilled labor in other lines of work received as much pay as skilled molders.

It seems, therefore, that if jobbing foundries are to attract young men capable of learning the molder's trade, better working conditions and sanitary facilities will have to be provided.

Some engineering concerns in Europe are making a determined effort to overcome the conditions in their foundries which may be considered objectionable. Physical examinations are to be made every three months, with special attention paid to feet and eyes. Arrangements are being considered to furnish employees with safety shoes and clothes, to launder the clothes every night, and to give every employee an opportunity to shower and change to clean street clothes before leaving the plant. Similar steps have been taken, in some cases long ago, by North American foundries.

There was a time when young men sought the opportunity to learn the molder's trade. They received better wages than other tradesmen and their skill was recognized. They were highly respected in the community. Hygenic conditions were no worse in foundries than in other branches of industry.

There is no doubt that a well organized safety and hygiene program, supported by progressive foundrymen, would help greatly to improve sanitary conditions in the foundry industry.

Robert Gregg

ROBERT GREGG
National Director
AMERICAN FOUNDRYMEN'S SOCIETY

National Director Robert Gregg was born on the Isle of Man and started work in foundries there in 1900, becoming a journeyman molder. Coming to the United States in 1907, he worked as molder and coremaker and in 1914 became foreman at the Steiger and Kerr Occidental Foundry, San Francisco. Later he was foreman for the Hesse-Martin Iron Works, Portland, Ore.; foundry superintendent, Keystone Iron and Steel Co., Los Angeles; and consultant and apprentice instructor for the Industrial Association of San Francisco. Joining Reliance Regulator Co., Alhambra, Calif., in 1927 as foundry superintendent, he has been foundry manager since 1940. Mr. Gregg, a member of A.F.S. since 1919, was first president of the Southern California chapter. He has long been active in recruiting and training apprentices for the industry.

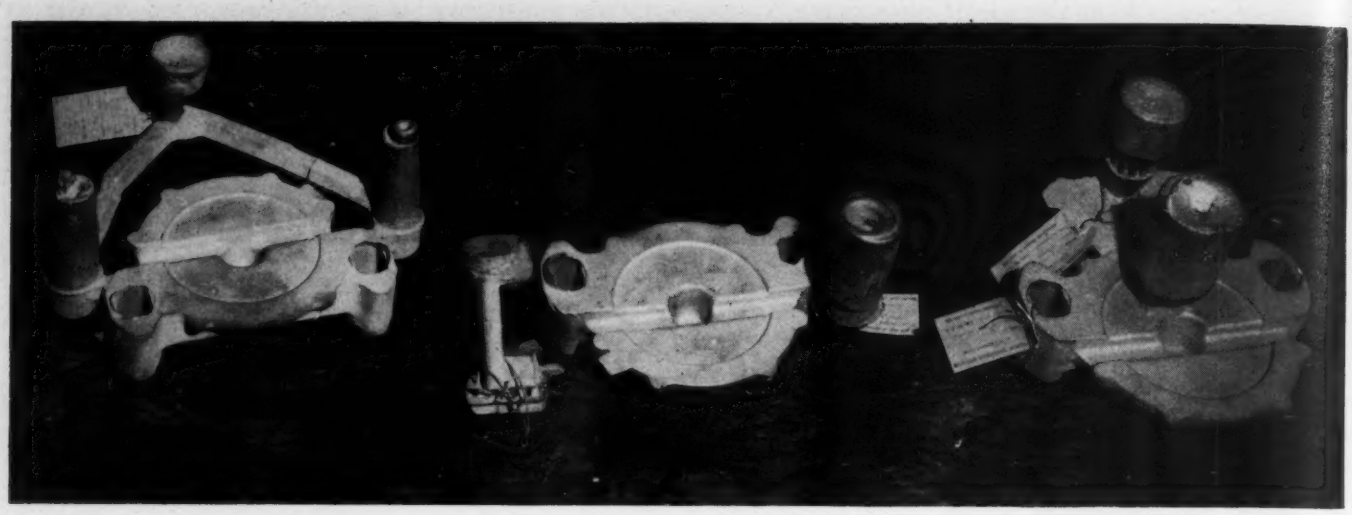


Fig. 1—Best castings, Gray Iron Molding Division. Left to right, 1st, 2nd, 3rd prize winners.

AN ANALYSIS OF ENTRIES IN THE 1948 A. F. S. APPRENTICE CONTEST

Roy W. Schroeder, Chairman, A.F.S. Apprentice Contest Committee, University of Illinois, Navy Pier Branch, Chicago

A WIDE DIVERGENCE OF THOUGHT on gating, risering, and pattern construction was shown in the record number of entries in the 25th Annual A.F.S. Apprentice Contest, which reached its climax with the presentation of awards to the national winners during the 52nd Annual Foundry Congress in Philadelphia.

In this year's contest, for the first time, a magnesium casting placed first in the Non-ferrous Division, plastic patterns and coreboxes were used for non-ferrous molding, and an entry was accompanied by a radiograph as proof of its internal soundness.

This year, a total of 64 contestants reached the national finals, an all-time record. In the local chapter contests, the number of entries surpassed those of any previous year, denoting a renewed interest among foundrymen in apprentice training. This record number of entries was achieved despite the fact that many chapters holding local contests declined to enter the national contest—preferring an additional year to prepare for entry into the 1949 Contest.

Fig. 2—Gray iron casting entries with low yield. Small riser neck on the casting at left makes it impossible for the molten metal to feed through to the heavy section.

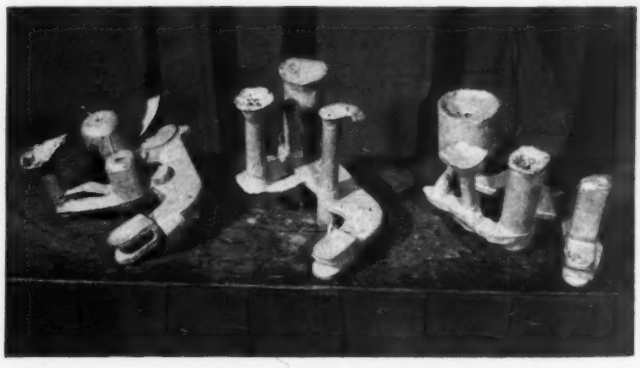


Fig. 3—Steel casting entries. (Left) Atmospheric pressure riser increases yield, but cold shut is apparent on slotted end and surface is rough. (Center) Riser is smaller than boss it is supposed to feed. (Right) Rectangular riser over slotted end makes for unnecessarily low yield. There are surface indications of wet sand or of hard ramming and washing of sand in the gate.

The following is an analysis and general discussion, made in the form of a constructive critique, of several of the national-contest entries.

On certain castings little thought was given to the yield, some giving 50 per cent or less. Entries with low yield are shown in Fig. 2 (left and right), 3 (right), 9 (center), and 11 (right). A number of entrants made the serious mistake of having the neck of the riser so small that it would be impossible for metal to feed through to the heavy section as in Fig. 2 (left). In one of the castings, a 4 in. head was connected to the casting by a neck approximately ¾ in. thick by 2 in. wide.

Some apprentice molders failed to choke the gate. This of course might result in dirty castings. In the

castings shown in Fig. 5 (center) and 4 (right) the part of the runner in the drag and the cope runner to the riser are of equal size, thus eliminating the usefulness of the former as a choke. This same mistake is shown in Fig. 9 (center) and 11 (right). The other extreme is reached by the use of two strainer cores in the same gate as in Fig. 2 (right). While this insures clean metal in the mold, it increases production costs, and entails a loss in production and a lower yield.

Stress Planning of Castings

When planning a piece of work, it is essential for the apprentice to examine the pattern carefully for gating, risering, pockets to be secured, placing of chills, and proper selection and means of securing chaplets. An example of a lack of such planning is shown in Fig. 4 (right), where the riser was apparently carelessly cut out with a tool, leaving a very rough surface at the neck of the riser. With this technique there is a good possibility of loose sand falling back into the mold and causing a dirty casting and sand inclusions.

Fig. 5—Gray iron castings. In castings at center and right, the part of the runner in the drag and the cope runner are of same size, thus eliminating use as choke.

Some of the apprentices increased the cleaning cost of their castings by placing heavy risers directly on top of the heavy sections. Failure to neck these risers would add to the difficulty of removing them by knocking off or burning. Many foundrymen who saw examples of this at the Apprentice Contest Exhibit at the Convention commented that this method of locating risers on top of the casting very often produces shrinkage which is revealed when the riser is removed. The majority preferred to have risers on the side.

Castings made with all of the runner in the drag are shown in Fig. 4 (left and center) and Fig. 5 (center and right). This is impractical for keeping slag and loose sand out of the casting. Equally impractical is the habit of making the runner in the cope so small that all metal entering the runner flows immediately into the casting through the gate openings.

Square Risers Not Recommended

A few of the castings illustrated by Fig. 5 (center), gave evidence of a lack of proper facing for the job. Proper facing is important because a rough casting has poor sales appeal.

In Fig. 3 (center) the casting has a riser smaller than the boss it is supposed to feed. In cases like this the casting frequently feeds the riser, resulting in internal shrinkage which is sometimes evident when the

Fig. 4—Gray iron castings. Left and center castings are made with all of the runner in the drag, impractical for excluding slag and loose sand. (Right) Riser is carelessly cut out with tool, leaving rough riser neck.

riser is removed. The riser shown in Fig. 3 (right) over the slotted end of the casting is of rectangular form. This type of riser is only as efficient as a riser the size of the largest circle that can be inscribed in it. Thus, a rectangular riser makes for an unnecessarily low yield and should not be used. This is also illustrated by the castings in Fig. 8 (left and center).

On some of the steel castings, the apprentices failed to neck the risers, thus adding to the cleaning cost. However, the risers on the three castings in Fig. 7 are properly necked and of sufficient size to feed the casting. External and internal chills of the right size helped insure sound castings.

Use of the atmospheric pressure riser with a resultant increase in yield is shown in Fig. 3 (left). This casting shows a cold shut on the slotted end, and a rough surface is apparent. Fig. 3 (right) has surface indications of wet sand or hard ramming, and some washing of sand in the gate.

As previously stated, this year for the first time a magnesium casting took first prize in the Non-ferrous Molding Division. The apprentice who made the casting exhibited a thorough knowledge of the gating and

Fig. 6—The author holds the second place entry in the Non-Ferrous Molding Division. A.F.S. Educational Assistant P. D. Johnson (right) is holding the magnesium casting which won top non-ferrous honors.

Fig. 7—Prize winning steel castings. Left to right, 2nd, 1st, 3rd place entries.

risering of this metal and of the establishment of the parting line. (See Fig. 6).

The casting shown in Fig. 11 (right) indicates a lack of planning—the runner is much too long and the drag runner much too large to take the part of a choke or skimmer. The yield here would be approximately 35 to 40 per cent, and the heavy fins would add to the cleaning cost. Fig. 9 (center) also shows a poor gating arrangement.

Figure 9 (left) shows an unusual gate arrangement and raises the question, "Why the center riser?" A proper choke or use of a strainer core would have

Fig. 8—Steel casting entries. Castings shown at left and center have low-yield because of rectangular risers.

Fig. 9—Non-ferrous entries. (Left) Unusual gate arrangement and extraneous center riser. Center and right castings indicate a lack of planning in gating.

eliminated this extra metal and served a more useful purpose. Most of the risers on the non-ferrous work are seemingly too large, thus reducing the yield. Apprentices should remember that each pound of metal melted, that does not go into the casting, increases the cost of that casting unnecessarily.

One non-ferrous casting had a small riser for the small boss, while in Fig. 10 (left) the use of a surface chill is indicated. The fact that all of the remaining castings came sound without the use of either would indicate that neither would be necessary with proper gating and temperature control.

Fig. 9 (right) and 10 (center) show lack of planning in gating, since the sprues were cut too far from the castings, making very long runners necessary. The longer the runner, the more chance for dirt, cold shuts, and higher remelt casts.

Patternmaking Contest

The various methods used in construction of the pattern entries brought out some lively discussion in the Pattern Division meeting. Some of the patternmakers believed that the apprentices should be told how to part the pattern and the type of construction to be used. This would put the contest on a workmanship and finish basis, and is based on the theory that it is better to teach the apprentice the best way of doing a job, rather than to let him continue to make mistakes.

Opponents of this theory claim that it would destroy the apprentices' initiative and that local characteristics of patterns and opinions on patternmaking would not be expressed in the contest entries.

Each pattern of the 1948 Contest was subjected to checking on 15 points, and it was necessary to recheck the top contestants before selecting the winners. The winning pattern in the national contest is shown in the center of Fig. 12, on the left is the second place winner, and the third place winner is on the right.

Most of the patterns entered were of simple construction, using a pattern support block or follow board. Second place was won by a contestant making use of a cover core. This simplifies the molding by making a flat back of the job and gives more rigid construction to the pattern. Cost of the core would have to be balanced against the lower rate of production that would be achieved if a loose pattern were used, and also against the cost of pattern repairs to the thin section,

which would be seriously damaged by the draw spike. The third prize went to an apprentice who used the mold board as a follow board. His pattern construction was the same as that of the first prize winner.

Several apprentices made a split pattern of the job, using a dry sand core made by booking. A thin casting of this kind would be subject to shrinkage cracks if the core were a little on the hard side. Construction of one of the patterns exhibited would increase molding cost, due to the lifting of the green sand core in the cope. On this pattern a small dry sand core, about ⅜ in. in diameter, made by the use of a split box, would add to the cost of production.

Apprentices and apprentice supervisors interested in the 1949 A.F.S. Apprentice Contest will profit by a study of judges' comments and by a review of previous articles on Contests. Judges' comments which were repeated at this year's judging are:

Patterns—Center lines were missing or not carried over to parting line. Short grain construction should be avoided. Draft should be sufficient but not too much. Excessive taper makes core-setting difficult. Witness-marks should be large enough to make a difference in core setting but not so large that they make molding or core setting difficult. Loose pieces should be properly seated.

Castings—Molders should strive for high yield consistent with soundness. Select sand and ram carefully to avoid swells, scabbing, cuts and washes, etc. Cut parting lines carefully to avoid finning. Place gates and risers so they may be removed with least difficulty. Draw the pattern and close the mold with care.

Articles in AMERICAN FOUNDRYMAN reviewing past contests are:

A. R. Luebke, "Benefits of Competitive Training," AMERICAN FOUNDRYMAN, December 1938, p. 11.

Martin Putz, "How An Apprentice Viewed the Contest," AMERICAN FOUNDRYMAN, December 1938, pp. 10-11.

Anonymous, "How Would You Make It?" AMERICAN FOUNDRYMAN, Dec. 1938, p. 10.

F. C. Cech, "A Resume of the 1939 Apprentice Patternmaking Contest," AMERICAN FOUNDRYMAN, February 1940, pp. 6-12.

F. C. Cech, "A Resume of the 1940 Apprentice Patternmaking Contest," AMERICAN FOUNDRYMAN, April 1941, pp. 13-17.

C .W. Wade, "Analysis of Gray Iron Castings Submitted in 1941 Apprentice Contest," AMERICAN FOUNDRYMAN, April 1942, pp. 27-30.

Fig. 10—Non-ferrous casting entries. (Left) Casting shows use of surface chill on small boss. Center casting has unnecessarily long runners which increase remelt.

Fig. 11—Non-ferrous casting entries. Casting at right has runner in drag and cope runner of equal size, shows general lack of planning and results in very low yield.

F. C. Cech, "Presents Critical Review of Patterns Submitted in 1941 Apprentice Contest," AMERICAN FOUNDRYMAN, January 1942, pp. 2-6.

F. C. Cech, "1942 Apprentice Patternmaking Contest Entries Mirror the Pattern Industry," AMERICAN FOUNDRYMAN, February 1943, pp. 8-14.

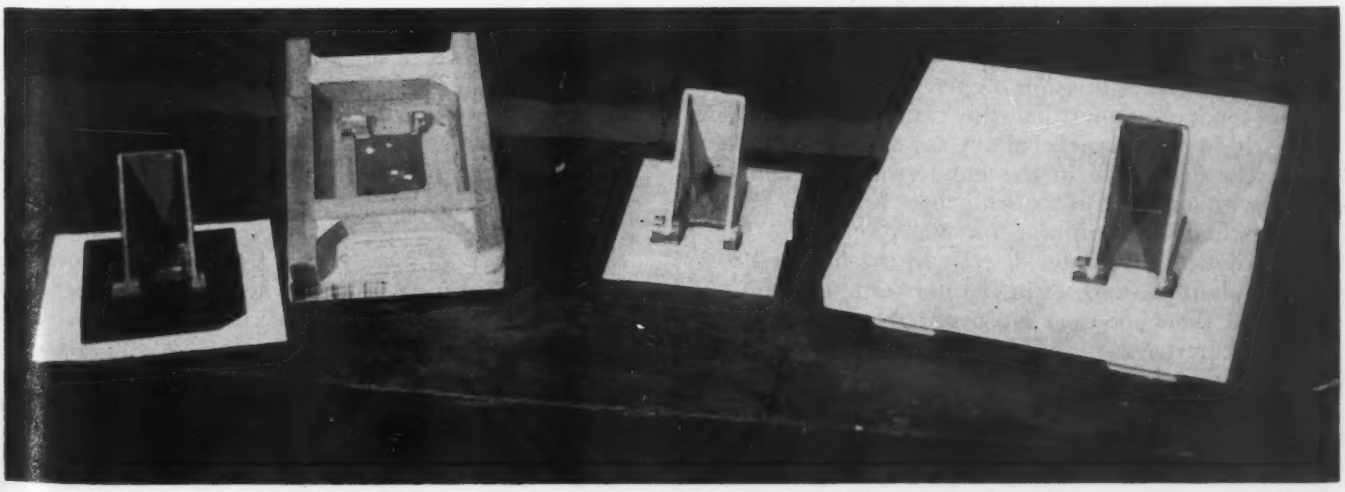
F. C. Cech, "1944 Patternmaking Contest," AMERICAN FOUNDRYMAN, September 1945, pp. 64-67.

F. C. Cech, "Variety Found in 1946 A.F.A. Apprentice Contest Patterns," AMERICAN FOUNDRYMAN, January 1947, pp. 61-64.

P. M. Sanders, "Apprentice Contest Results," AMERICAN FOUNDRYMAN, March 1947, pp. 38-41.

L. F. Tucker, "1947 Apprentice Contest Pattern Division Entries Take Many Forms," AMERICAN FOUNDRYMAN, November 1947, pp. 56-57.

Fig. 12—Winning entries in the Patternmaking Division. Left to right, 2nd, 1st, 3rd prize winners.



OPEN '49 ANNUAL A.F.S. APPRENTICE CONTEST

OPENING OCTOBER 15, the 1949 A.F.S. Apprentice Contest again offers apprentices in molding and patternmaking an opportunity to test their skill and knowledge of foundry practice in competition with the best on the North American continent. In its 26th year, the contest is open to indentured apprentices in any shop who meet entrance requirements.

Winners Awarded Prizes, Convention Trip

Competition is open in steel molding, gray iron molding, non-ferrous molding, and patternmaking with prizes of $100, $50, and $25 for the winners in each division. All winners receive a certificate of recognition, and in addition, the four first prize winners receive round trip rail and Pullman fare to enable them to attend the A.F.S. Annual Convention in St. Louis, May 2-5, 1949. A breakfast in honor of the winners, with A.F.S. Apprentice Contest Committee members as hosts will be held prior to awarding of prizes. Certificates and prizes will be presented by A.F.S. President W. B. Wallis at the Annual Meeting during the Convention. A visit to an outstanding St. Louis foundry is planned for the first prize winners following presentation of awards.

Contest Requirements

Official entry blanks for the 1949 A.F.S. Apprentice Contest are available from American Foundrymen's Society, 222 West Adams St., Chicago 6, Ill., or from Educational and Apprentice Committee members of A.F.S. Chapters. To enter the contest it is not necessary to be an A.F.S. member nor to be affiliated with a shop represented in the Society. Any apprentice taking a training course of not less than three years duration, who is not over 24 years of age on the day he competes in the contest, is eligible. Veterans of World War II are eligible if their age less their term of service is not over 24.

All Molders Use Same Type Pattern

Blueprints for the pattern division of the contest, and patterns for the molding divisions, are furnished by A.F.S. This year, for the first time, the patterns for the same casting will be used for all three molding divisions. Castings produced are expected to illustrate the different types of gating and risering used for the various alloys.

The non-ferrous division is open to apprentices making all types of non-ferrous alloy castings. Copper-base alloys, light metals, nickel alloys, etc. all are acceptable. Last year first place in the non-ferrous division was taken with a magnesium casting after brass and bronze castings had been winning for many years.

Apprentices may enter directly in the national contest, in plant contests, or in chapter contests. Apprentices and their sponsors are urged to consult officers of the nearest A.F.S. chapter before entering directly in the national contest.

Last day for entering the 1949 A.F.S. Apprentice Contest is March 15. Judging will take place in St. Louis early in April. All castings and patterns entered in the finals will be exhibited during the 1949 Annual Convention of A.F.S. in St. Louis, May 2-5. The three prize winners in each division will be on display during the following year as part of the A.F.S. foundry exhibit in the Museum of Science and Industry, Chicago.

E. J. McAfee (right), master patternmaker, Puget Sound Naval Shipyard, Bremerton, Wash., congratulates (left to right) Philip Sorenson, Donald Bogart, and Donald Smith, winners of 2nd, 3rd, and 1st prizes respectively, in a Shipyard apprentice patternmaking contest. Mr. McAfee, who is a director and apprentice contest chairman of the A.F.S. Washington Chapter, devised the plant contest, based on A.F.S. apprentice contest procedure, to check the efficiency of the Shipyard's training methods, and as a trial run in preparation for the 1949 A.F.S. Apprentice Contest. (This photograph reproduced courtesy United States Navy).

Contest Committee Personnel

Plans for the 1949 A.F.S. Apprentice Contest were made by the Apprentice Contest Committee composed of the following:

Chairman, R. W. Schroeder, foundry instructor, Chicago Navy Pier Branch, University of Illinois; *vice-chairman,* C. W. Morisette, assistant professor of industrial engineering, Pennsylvania State College, State College, Pa.; *secretary,* J. A. Havnen, assistant foundry superintendent, Wells Mfg. Co., Skokie, Ill.; G. E. Garvey, vice-president, City Pattern & Foundry Co., South Bend, Ind.; A. C. Gocher, foundry superintendent, Fletcher Works, Inc., Philadelphia; E. P. Meyer, general superintendent, Chain Belt Co., Milwaukee; Wayne Stettbacher, secretary, Employers Association of Detroit; G. Ewing Tait, assistant manager of manufacturing, Dominion Engineering Works, Ltd., Montreal; F. W. Burgdorfer, president, Missouri Pattern Works, St. Louis; Harry J. Jacobson, owner, Industrial Pattern Works, Chicago; and G. A. Zabel, assistant superintendent, Universal Foundry Co., Oshkosh, Wis.

For further details concerning the rules and regulations of the 1949 A.F.S. Apprentice Contest, write to the American Foundrymen's Society, 222 West Adams St., Chicago 6, Ill.

A.F.S. USES PUNCH CARD SYSTEM TO INDEX FOUNDRY LITERATURE

NEED FOR AN EFFICIENT METHOD of classifying and filing references to technical foundry literature is becoming more acute as the volume of literature increases. A filing cabinet full of bibliographic literature reference cards is less than useless if one cannot quickly and efficiently select reference cards which are applicable to the problem at hand. Herein discussed is a punch card keysorting method to serve the needs of the foundry engineer, metallurgist, foundry sand technician and the foundry operator.

Foundry Literature Code Index

The basis for this system is the accompanying code index which covers practically all phases of foundry practice. Since the American Foundrymen's Society functions through its several divisions and general interest committees, this code index was developed along lines of divisional and committee interests. Hence, the 200 series in the code index covers aluminum alloys; the 300 series covers magnesium alloys. Likewise, the 600 series covers gray iron, while the 900 series covers foundry sand, and the 1100 series covers foundry patterns and patternmaking. It becomes evident, therefore, that a foundryman need use only those sections of the code index which are specifically applicable to his needs. This code can be expanded as the need arises.

Punch Card

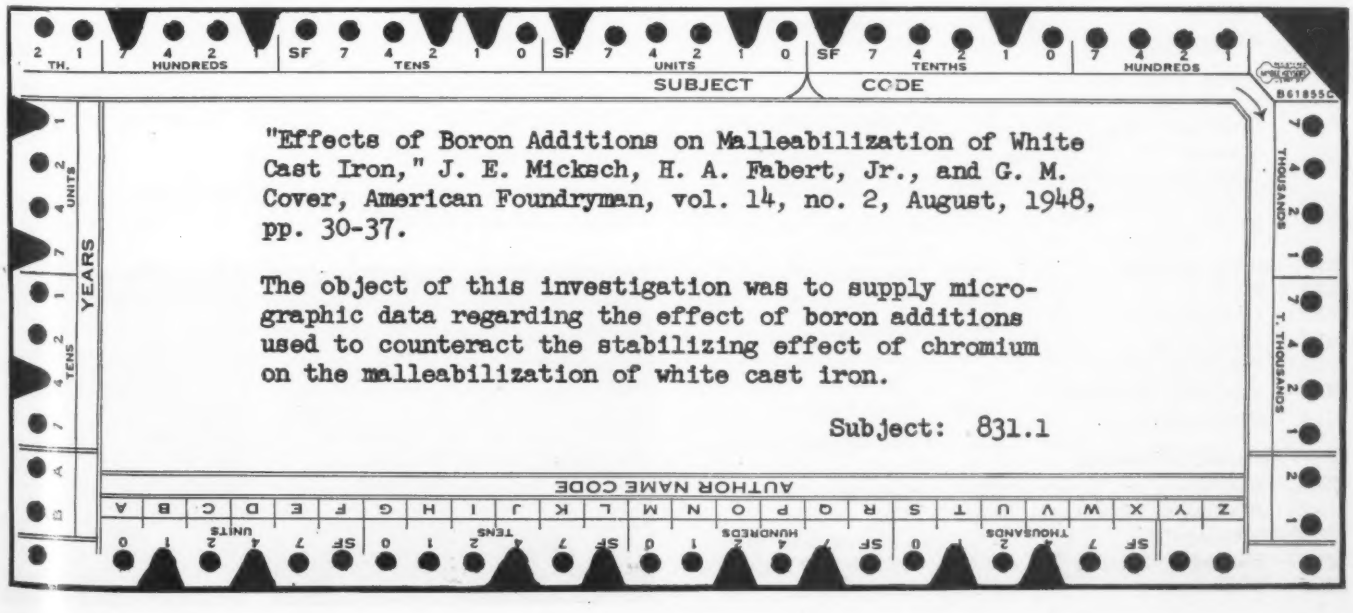
A 7½-in. by 3¼-in. punch card with perforations or punched holes along the borders for use in connection with this code index is herein illustrated. It is in the straight-up position when the diagonally-cut corner is in the upper right. The perforations are in groups as shown. The groups of perforations are labelled SF, 7, 4, 2, 1, 0 which are punched or slotted as later described in accordance with the classification in the code index. These digits, individually or in combinations, are used to punch numbers up to 9 in each group.

The notches or slots in the cards corresponding to the classification number are made individually with a hand slotting punch which is similar to the paper punch commonly found in offices. This type of punch is used when the volume of cards to be punched is small and does not justify investment in an automatic punching machine such as illustrated in one of the accompanying photographs.

A keyboard punching or slotting machine is desirable for making the slots or notches along the edges of the cards when the volume of cards handled is large. The keyboard of the automatic slotting machine looks and operates very much like an adding machine. To punch out the required numbers or classifications along the edges of the card the operator simply inserts the card in the machine, presses the proper keys for the classifying code index numbers, and pulls forward the handle of the hand-operated model.

To illustrate, let us classify the article, "Effects of Boron Additions on Malleabilization of White Cast Iron" by J. E. Micksch, H. A. Fabert, Jr. and G. M. Cover in the August, 1948 issue of AMERICAN FOUNDRYMAN. The code index number for this article is 831.1 (*q.v.*) since it deals with annealing of malleable iron.

Hence, if we use a hand slotting punch we would, starting from the left-hand side of the card and working toward the right, punch the series number first, i.e., the number 8. To do this we would punch digits 7 and 1 under hundreds, which add up to 8. Then we would punch the digits 2 and 1 for digit 3 under tens, then digit 1 and SF under units and similarly for digit 1 under tenths. SF means single figure and is the means by which extraneous cards are eliminated in the keysorting operation. SF is punched only for a single


SUBJECT
CODE
"Effects of Boron Additions on Malleabilization of White Cast Iron," J. E. Micksch, H. A. Fabert, Jr., and G. M. Cover, American Foundryman, vol. 14, no. 2, August, 1948, pp. 30-37.
The object of this investigation was to supply micrographic data regarding the effect of boron additions used to counteract the stabilizing effect of chromium on the malleabilization of white cast iron.
Subject: 831.1
AUTHOR NAME CODE

Type of punch card used for classifying and filing technical foundry literature in the code index system.

FOUNDRY LITERATURE—PUNCH CARD CODE INDEX

100 General Information

101 General
101.1 History of Foundry Practice
101.2 Patents
101.3 Statistics—General
101.31 Statistical Analysis
101.32 Metal Economics
101.4 Specifications and Codes
101.5 Books on Foundry Practice

105 Bibliographies
106 Dictionaries, Encyclopedias

108 A.F.S. Publications
109 American Publications
110 British Publications
111 Canadian Publications
112 Australian Publications
113 French Publications
114 South American Publications
115 German Publications
116 Other Society Publications
118 Foreign Language Publications
119 Writing Manuals
120 Teaching Manuals
121 Mathematics
122 Physics
123 Organic Chemistry
124 Inorganic Chemistry

200 Aluminum

201 General
201.1 History
201.2 Patents
201.3 Production Statistics
201.4 Specifications
201.5 Books

205 Manufacture of Al Ingot
205.1 Virgin
205.2 Secondary

211 Melting
211.1 Equipment
211.2 Temperature Control
211.3 Refinement
211.4 Precautions
211.5 Fluxes
211.6 Atmosphere

215 Molding & Coremaking
215.1 Equipment
Sand (see 911.1)
215.3 Washes
Cores (see 935.1)
215.5 Gates
215.6 Risers

221 Casting Methods
221.1 Sand
221.2 Centrifugal
221.3 Die Casting
221.4 Permanent Mold
221.5 Precision Investment
221.6 Plaster Mold

225 Cleaning & Finishing
225.1 Shakeout
225.2 Blasting & Tumbling
225.3 Pickling
225.4 Cutting & Grinding
225.5 Electrolytic
225.6 Polishing
225.7 Electroplating
225.8 Coloring
225.9 Painting, Lacquering
225.91 Ceramic (Vitreous)
225.92 Welding
225.93 Impregnation

231 Heat Treatment
231.1 Annealing
231.2 Solution
231.3 Aging
231.4 Temperature Control

235 Design of Al Castings

241 Properties
241.1 Mechanical
241.2 Physical
241.3 Chemical
241.4 Magnetic
241.5 Effect of Elements
241.51 Chromium
241.52 Cobalt
241.53 Copper
241.54 Iron
241.55 Magnesium
241.56 Manganese
241.57 Nickel
241.58 Silicon
241.59 Tin
241.6 Titanium
241.61 Vanadium
241.62 Zinc

241.9 Effect of Gases
241.91 Hydrogen
241.92 Oxygen
241.93 Nitrogen

245 Tests & Testing
245.1 Destructive
245.2 Non-Destructive

251 Chemical Analysis
251.1 Wet Methods
251.2 Spectrographic Methods
251.3 Manuals

255 Casting Defects—Causes & Prevention

261 Machining

265 Metallurgy
265.1 Fluidity
265.2 Metallography
265.3 Heat Transfer

271 Applications

275 Aluminum-Copper Alloys
275.1 Non-Heat Treated
275.2 Heat Treated

276 Aluminum-Silicon Alloys
276.1 Non-Heat Treated
276.2 Heat Treated

277 Aluminum-Silicon-Copper Alloys
277.1 Non-Heat Treated
277.2 Heat Treated

278 Aluminum-Magnesium Alloys
278.1 Non-Heat Treated
278.2 Heat Treated

279 Aluminum-Zinc Alloys
279.1 Non-Heat Treated
279.2 Heat Treated

300 Magnesium

301 General
301.1 History
301.2 Patents
301.3 Production Statistics
301.4 Specifications
301.5 Books

305 Manufacture of Mg Ingot
305.1 Virgin
305.2 Secondary

311 Melting
311.1 Equipment
311.2 Temperature Control
311.3 Refinement
311.4 Precautions
311.5 Fluxes
311.6 Atmosphere (Protective)
311.7 Grain Refining

315 Molding & Coremaking
315.1 Equipment
Sand (see 911.2)
315.3 Washes
Cores (see 935.2)
315.5 Gates
315.6 Risers

321 Casting Methods
321.1 Sand
321.2 Centrifugal
321.3 Die Casting
321.4 Permanent Mold
321.5 Precision Investment
321.6 Plaster Mold

325 Cleaning & Finishing
325.1 Shakeout
325.2 Blasting & Tumbling
325.3 Pickling
325.4 Cutting & Grinding
325.92 Welding
325.93 Impregnation
325.94 Rotary Filing

331 Heat Treatment
331.2 Solution
331.3 Aging
331.4 Temperature Control
331.5 Stabilization Heat Treatment

335 Design of Mg Castings

341 Properties
341.1 Mechanical
341.2 Physical
341.3 Chemical
341.4 Magnetic
341.5 Effect of Elements
341.53 Copper
341.56 Manganese
341.58 Silicon
341.62 Zinc
341.63 Aluminum
341.64 Cadmium
341.65 Cerium
341.66 Silver

341.9 Effect of Gases
341.91 Hydrogen
341.92 Oxygen
341.93 Nitrogen

345 Tests & Testing
345.1 Destructive
345.2 Non-Destructive

351 Chemical Analysis
351.1 Wet Method
351.2 Spectrographic Methods
351.3 Manuals

355 Casting Defects—Causes & Prevention

361 Machining

365 Metallurgy
365.1 Fluidity
365.2 Metallography
365.3 Heat Transfer

371 Applications

375 Magnesium-Base Alloys

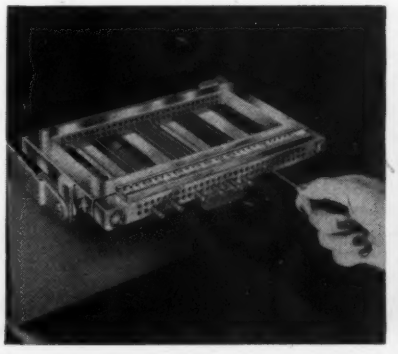
400 Brass

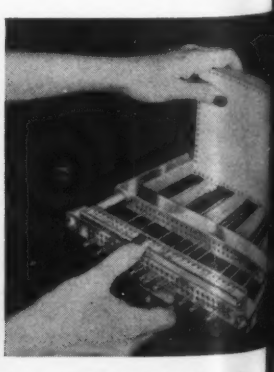
401 General
401.1 History
401.2 Patents
401.3 Production Statistics
401.4 Specifications
401.5 Books

405 Manufacture of Ingot
405.1 Virgin
405.2 Secondary

411 Melting
411.1 Equipment
411.2 Temperature Control
411.4 Precautions

Use of selector for card sorting operation (left to right)—Placing needles in the chase for each classification





411.5 Fluxing & Deoxidizing
411.6 Atmosphere Control

411.8 Refractories

415 Molding & Coremaking
415.1 Equipment
Sand (see 911.3)
415.3 Washes
Cores (see 935.3)
415.5 Gates
415.6 Risers

421 Casting Methods
421.1 Sand
421.2 Centrifugal
421.3 Die Casting
421.4 Permanent Mold
421.5 Precision Investment
421.6 Plaster Mold
421.7 Slush Casting

425 Cleaning & Finishing
425.1 Shakeout
425.2 Blasting & Tumbling
425.3 Pickling
425.4 Cutting & Grinding

425.92 Welding & Brazing
425.93 Impregnation

431 Heat Treatment
431.1 Annealing
431.2 Solution
431.3 Aging
431.4 Temperature Control

435 Design of Brass Castings

441 Properties
441.1 Mechanical
441.2 Physical
441.3 Chemical
441.4 Magnetic
441.5 Effect of Elements

441.54 Iron

441.57 Nickel
441.58 Silicon

441.63 Aluminum

441.67 Antimony
441.68 Phosphorus
441.69 Sulphur

441.9 Effect of Gases
441.91 Hydrogen
441.92 Oxygen
441.93 Nitrogen

445 Tests & Testing
445.1 Destructive
445.2 Non-Destructive

451 Chemical Analysis
451.1 Wet Method
451.2 Spectrographic Methods
451.3 Manuals

455 Casting Defects—Causes & Prevention

461 Machining

465 Metallurgy
465.1 Fluidity
465.2 Metallography
465.3 Heat Transfer

471 Applications

475 Brass Alloys

476 Red Brass
476.1 Leaded Red Brass

477 Semi-Red Brass
477.1 Leaded Semi-Red Brass

478 Yellow Brass
478.1 Leaded Yellow Brass

479 High Strength Yellow Brass
479.1 Leaded High Strength Yellow Brass

481 Silicon Brass

482 Tin Brass

483 Tin-Nickel Brass

484 Nickel Brass (Nickel Silver)
484.1 Leaded Nickel Brass

485 Manganese Bronze (Brass)

500 Bronze

501 General
501.1 History
501.2 Patents
501.3 Production Statistics
501.4 Specifications
501.5 Books

505 Manufacture of Ingot
505.1 Virgin
505.2 Secondary

511 Melting
511.1 Equipment
511.2 Temperature Control
511.4 Precautions
511.5 Fluxing & Deoxidizing
511.6 Atmosphere Control
511.8 Refractories

515 Molding & Coremaking
515.1 Equipment
Sand (see 911.4)
515.3 Washes
Cores (see 935.4)
515.5 Gates
515.6 Risers

521 Casting Methods
521.1 Sand
521.2 Centrifugal
521.3 Die Casting
521.4 Permanent Mold
521.5 Precision Investment
521.6 Plaster Mold
521.7 Slush Casting

525 Cleaning & Finishing
525.1 Shakeout
525.2 Blasting & Tumbling
525.3 Pickling
525.4 Cutting & Grinding

525.92 Welding & Brazing
525.93 Impregnation

531 Heat Treatment
531.1 Annealing
531.2 Solution
531.3 Aging
531.4 Temperature Control

535 Design of Bronze Castings

541 Properties
541.1 Mechanical
541.2 Physical
541.3 Chemical
541.4 Magnetic
541.5 Effect of Elements

541.54 Iron

541.57 Nickel
541.58 Silicon

541.63 Aluminum

541.67 Antimony
541.68 Phosphorus
541.69 Sulphur

541.9 Effect of Gases
541.91 Hydrogen
541.92 Oxygen
541.93 Nitrogen

545 Tests & Testing
545.1 Destructive
545.2 Non-Destructive

551 Chemical Analysis
551.1 Wet Method
551.2 Spectrographic Methods
551.3 Manuals

555 Casting Defects—Causes & Prevention

561 Machining

565 Metallurgy
565.1 Fluidity
565.2 Metallography
565.3 Heat Transfer

571 Applications
575 Bronze Alloys
581 Silicon Bronze

582 Tin Bronze
582.1 Leaded Tin Bronze
582.2 High-Leaded Tin Bronze

584 Nickel Bronze
584.1 Leaded Nickel Bronze

586 Aluminum Bronze

587 Beryllium Bronze
588 Lead Bronze

600 Gray Iron

601 General
601.1 History
601.2 Patents
601.3 Production Statistics
601.4 Specifications
601.5 Books

605 Raw Materials
605.1 Steel Scrap
605.2 Pig Iron
605.3 Ferro Alloys
605.4 Charge Calculations
605.5 Coke
605.6 Flux

611 Melting
611.1 Equipment
611.11 Cupola Furnace
611.12 Electric Arc Furnace
611.13 Induction Furnace
611.14 Brackelsberg
611.15 Blast Furnace
611.16 Oxygen-Enriched Furnace

611.2 Temperature Control

611.4 Precautions
611.5 Fluxes
611.6 Atmosphere

615 Molding & Coremaking
615.1 Equipment
Sand (see 911.5)
615.3 Washes
Cores (see 935.5)
615.5 Gates
615.6 Risers

621 Casting Methods
621.1 Sand
621.2 Centrifugal
621.3 Die Casting
621.4 Permanent Mold
621.5 Precision Investment
621.6 Plaster Mold
621.7 Slush Casting
621.8 Loam

625 Cleaning & Finishing
625.1 Shakeout
625.2 Blasting & Tumbling
625.3 Pickling
625.4 Cutting & Grinding
625.5 Electrolytic

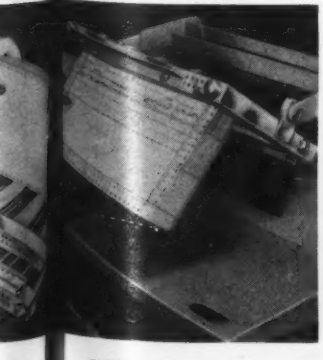
625.92 Welding & Brazing
625.93 Impregnation

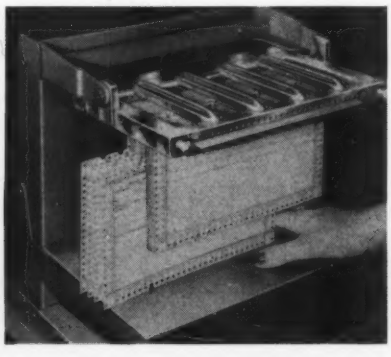
631 Heat Treatment
631.1 Annealing

631.4 Temperature Control

631.6 Flame Hardening
631.7 Induction Hardening
631.8 Stress Relief

desired; selector head pulled back and cards inserted; chase is turned over and the desired cards dropped.





631.9 Quenching & Tempering
631.91 Furnaces

635 Design of Gray Iron Castings

641 Properties
641.1 Mechanical
641.2 Physical
641.3 Chemical
641.4 Magnetic
641.5 Effect of Elements
641.51 Chromium

641.53 Copper
641.56 Manganese
641.58 Silicon
641.59 Tin

641.6 Titanium
641.61 Vanadium

641.63 Aluminum

641.65 Cerium

641.68 Phosphorus
641.69 Sulphur

641.7 Boron
641.71 Calcium
641.72 Molybdenum
641.73 Selenium
641.74 Tellurium
641.75 Tungsten
641.76 Bismuth

641.9 Effect of Gases
641.91 Hydrogen
641.92 Oxygen
641.93 Nitrogen

645 Tests & Testing
645.1 Destructive
645.2 Non-Destructive

651 Chemical Analysis
651.1 Wet Method
651.2 Spectrographic Methods
651.3 Manuals

655 Casting Defects—Causes & Prevention

661 Machining

665 Metallurgy
665.1 Fluidity
665.2 Metallography
665.3 Heat Transfer
665.4 External Chills
665.5 Rate of Solidification
665.6 Grain Size
665.7 Hardenability
665.8 Inoculation

671 Applications

675 Alloy Cast Irons

700 Steel

701 General
701.1 History
701.2 Patents
701.3 Production Statistics
701.4 Specifications
701.5 Books

705 Raw Materials
705.1 Steel Scrap
705.2 Pig Iron
705.3 Ferro Alloys
705.4 Charge Calculations

711 Melting
711.1 Equipment
711.12 Electric Arc Furnace
711.121 Acid
711.122 Basic
711.13 Electric Induction Furnace
711.131 Acid
711.132 Basic
711.17 Open-Hearth Furnace
711.171 Acid
711.172 Basic
711.18 Converter
711.181 Side-Blown
711.1811 Acid
711.1812 Basic
711.182 Bottom-Blown
711.1821 Acid
711.1822 Basic
711.19 Crucible
711.191 Thermit Method

711.2 Temperature Control

711.4 Precautions
711.5 Fluxes
711.6 Atmosphere

711.8 Refractories
711.9 Slag

715 Molding & Coremaking
715.1 Equipment
Sand (see 911.7)
715.3 Washes
Cores (see 935.7)
715.5 Gates
715.6 Risers

721 Casting Methods
721.1 Sand
721.2 Centrifugal
721.3 Die Casting
721.4 Permanent Mold
721.5 Precision Investment
721.6 Plaster Mold
721.7 Slush Casting
721.8 Loam

725 Cleaning & Finishing
725.1 Shakeout
725.2 Blasting & Tumbling
725.3 Pickling
725.4 Cutting & Grinding
725.5 Electrolytic

725.92 Welding & Brazing
725.93 Impregnation

731 Heat Treatment
731.1 Annealing

731.4 Temperature Control

731.6 Flame Hardening
731.7 Induction Hardening
731.8 Stress Relief
731.9 Quenching & Tempering

731.91 Furnaces
731.92 Normalizing

735 Design of Steel Castings

741 Properties
741.1 Mechanical
741.2 Physical
741.3 Chemical
741.4 Magnetic
741.5 Effect of Elements
741.51 Chromium

741.53 Copper

741.59 Tin
741.6 Titanium
741.61 Vanadium

741.63 Aluminum

741.68 Phosphorus
741.69 Sulphur
741.7 Boron
741.71 Calcium
741.72 Molybdenum
741.73 Selenium
741.74 Tellurium
741.75 Tungsten

749.9 Effect of Gases
741.91 Hydrogen
741.92 Oxygen
741.93 Nitrogen
741.94 Carbon Dioxide
741.95 Carbon Monoxide

745 Tests & Testing
745.1 Destructive
745.2 Non-Destructive

751 Chemical Analysis
751.1 Wet Method
751.2 Spectrographic Methods
751.3 Manuals

755 Casting Defects—Causes & Prevention

761 Machining

765 Metallurgy
765.1 Fluidity
765.2 Metallography
765.3 Heat Transfer
765.4 External Chills
765.5 Rate of Solidification
765.6 Grain Size
765.7 Hardenability

771 Applications

775 Alloy Cast Steels
775.1 Chromium Steels
775.2 Manganese Steels
775.3 Molybdenum Steels
775.4 Nickel Steels
775.5 Vanadium Steels

800 Malleable Iron

801 General
801.1 History
801.2 Patents
801.3 Production Statistics
801.4 Specifications
801.5 Books

805 Raw Materials
805.1 Steel Scrap
805.2 Pig Iron
805.3 Ferro Alloys
805.4 Charge Calculations
805.5 Coke (Fuel)
805.6 Flux

811 Melting
811.1 Equipment
811.11 Cupola Furnace
811.12 Electric Arc Furnace
811.121 Acid
811.122 Basic
811.17 Open-Hearth Furnace
811.171 Acid
811.172 Basic
811.194 Air Furnace
811.195 Duplexing
811.196 Triplexing

811.2 Temperature Control

811.4 Precautions

811.6 Atmosphere

811.8 Refractories
811.9 Slag

815 Molding & Coremaking

Punched cards may be hand sorted with a single needle.

Operator punching index cards on a keyboard machine.

815.1 Equipment
Sand (see 911.6)
815.3 Washes
Cores (see 935.6)
815.5 Gates
815.6 Risers

821 Casting Methods
821.1 Sand
821.2 Centrifugal
821.3 Die Casting
821.4 Permanent Mold
821.5 Precision Investment
821.6 Plaster Mold

821.8 Loam

825 Cleaning & Finishing
825.1 Shakeout
825.2 Blasting & Tumbling
825.3 Pickling
825.4 Cutting & Grinding

825.92 Welding & Brazing
825.93 Impregnation

831 Heat Treatment
831.1 Annealing

831.4 Temperature Control

831.6 Flame Hardening
831.7 Induction Hardening

831.91 Furnaces

835 Design of Malleable Castings

841 Properties
841.1 Mechanical
841.2 Physical
841.3 Chemical
841.4 Magnetic
841.5 Effect of Elements
841.51 Chromium
841.52 Cobalt
841.53 Copper
841.55 Magnesium
841.56 Manganese
841.57 Nickel
841.58 Silicon
841.59 Tin
841.6 Titanium
841.61 Vanadium

841.63 Aluminum
841.64 Cadmium
841.65 Cerium

841.68 Phosphorus
841.69 Sulphur
841.7 Boron

841.72 Molybdenum
841.73 Selenium
841.74 Tellurium

841.77 Zirconium

841.9 Effect of Gases

841.91 Hydrogen
841.92 Oxygen
841.93 Nitrogen

845 Tests & Testing
845.1 Destructive
845.2 Non-Destructive

851 Chemical Analysis
851.1 Wet Method
851.2 Spectrographic Methods
851.3 Manuals

855 Casting Defects—Causes & Prevention

861 Machining

865 Metallurgy
865.1 Fluidity
865.2 Metallography
865.3 Heat Transfer
865.6 Grain Size

871 Applications

900 Foundry Sand

901 General
901.1 History

901.3 Production Statistics
901.4 Specifications
901.5 Books

905 Source of Foundry Sands

911 Preparation of Foundry Sands
911.1 At Source
911.2 At Foundry (Mulling Conditioning, etc.)

915 Specific Uses of Foundry Sand (Molding)
915.1 For Al Alloys
915.2 For Mg Alloys
915.3 For Brass
915.4 For Bronze
915.5 For Gray Iron
915.6 For Malleable Iron
915.7 For Steel

921 Sand Reclamation
921.1 Equipment
921.2 Process

925 Sand Control in Foundry

935 Core Sand Mixtures
935.1 Al
935.2 Mg
935.3 Brass
935.4 Bronze
935.5 Gray Iron
935.6 Malleable Iron
935.7 Steel

941 Foundry Sand Properties
941.1 Sampling
941.2 Specimens
941.3 Moisture Content
941.4 Permeability
941.5 Green Strength
941.6 Dry Strength
941.7 Grain Fineness
941.8 Sintering Point
941.9 Green Surface Hardness
941.91 Core Binders
941.92 Core Pastes
941.93 Gas Content

951 Chemical Analysis
951.1 Wet Method
951.2 Spectrographic Method
951.3 Petrographic Method
951.4 Manuals

1000 Precision Investment Casting

1001 General
1001.1 History
1002.2 Patents
1001.3 Production Statistics
1001.4 Specifications
1001.5 Books

1005 Materials
1005.1 Pattern
1005.2 Casting
1005.3 Investment

1005.91 Permanent
1005.92 Expendable

1011 Melting
1011.1 Equipment
1011.2 Temperature Control

1011.4 Precautions

1011.6 Atmosphere Control

1011.8 Refractories

1015 Molding & Coremaking
1015.1 Equipment
Sand (see 915.1-915.7)

1015.3 Washes
Cores (see 935.1-935.7)
1015.5 Gates
1015.6 Risers

1021 Casting Methods
1021.1 Centrifugal
1021.8 Gravity Feed

1025 Cleaning & Finishing

1025.2 Blasting (Grit)
1025.3 Pickling
1025.4 Cutting & Grinding

1025.7 Electroplating

1025.96 Plating
1025.97 Scratch Brushing
1025.98 Cold Water
1025.99 Steam

1031 Heat Treatment

1031.4 Temperature Control

1031.9 Quenching
1031.91 Case Hardening

1035 Design of Castings

1041 Properties
1041.1 Mechanical
1041.2 Physical
1041.3 Chemical
1041.4 Magnetic

1045 Tests & Testing
1045.1 Destructive
1045.2 Non-Destructive

1051 Chemical Analysis
1055 Casting Defects—Causes & Prevention

1061 Machining

1065 Metallurgy
1065.1 Fluidity
1065.2 Metallography
1065.3 Heat Transfer

1065.6 Grain Size
1065.7 Hardenability

1071 Applications

1100 Foundry Patterns & Patternmaking

1101 General
1101.1 History
1101.4 Specifications
1101.5 Books

1105 Patternmaking Tools & Machinery

1111 Pattern Materials
1111.1 Wood
1111.2 Metals
1111.3 Plastics
1111.4 Plaster
1111.5 Rubber
1111.6 Cast Stone

1115 Pattern Types
1115.1 Match Plates
1115.2 Split Patterns
1115.3 Skeleton Patterns
1115.4 Sweep Patterns

1135 Pattern Design
1135.1 Allowances
1135.2 Draft Angles
1135.3 Prints
1135.4 Rapping & Drawing Plates

1141 Pattern Construction
1141.1 Adhesives for Patternmaking

1145 Pattern Finishing
1145.1 Color Code
1145.2 Finishes

1151 Checking & Inspection of Patterns

1155 Storage of Patterns

1161 Core Boxes
1161.1 Rigging
1161.2 Core Blowing

1200 Foundry Refractories

1201 General
1201.1 History
1201.2 Patents
1201.3 Statistics
1201.4 Specifications
1201.5 Books

1205 Raw Materials (in Manufacture of Refractories)
1205.1 Clays
1205.2 Silica Minerals
1205.3 Magnesite & Lime
1205.4 Chromite
1205.5 Silicon Carbide
1205.6 Carbon
1205.7 Synthetic Materials

1215 Molding Methods
1215.1 Casting Process
1215.2 Soft-Mud Process
1215.3 Stiff-Mud Process
1215.4 Dry Press Process

1221 Drying of Refractories

1235 Properties of Refractories
1235.1 Fusion Point
1235.2 Load-Bearing Capacity
1235.3 Spalling
1235.4 Reactions Between Refractories and Slags
1235.5 Expansion & Shrinkage
1235.6 Heat Transmission by Refractories
1235.7 Miscellaneous Properties of Refractories

1241 Sizes & Tolerances

1271 Applications
1271.1 In Cupola
1271.2 In Open-Hearth Furnace
1271.3 In Air Furnace
1271.4 In Brackelsberg Furnace
1271.5 In Converter
1271.6 In Electric Arc Furnace
1271.7 In High Frequency Induction Melting Furnace

1275 Refractories for Crucibles

1281 Petrographic Methods
1285 Mineralogical Methods

1300 Foundry Plant & Layout Equipment

1301 General
1301.1 History
1301.4 Specifications (Plans)
1301.5 Books on Foundry Plants

1305 Foundry Plant Layout
1305.1 Al & Mg Foundries
1305.2 Brass & Bronze Foundries
1305.3 Gray Iron Foundries
1305.4 Steel Foundries
1305.5 Malleable Foundries

1311 Melting Equipment
1311.1 Cupola & Auxiliaries
1311.2 Open-Hearth Furnace
1311.3 Converter
1311.4 Electric Arc Furnace
1311.5 Induction Furnace
1311.6 Crucible Furnace

1315 Molding & Coremaking Equipment
1315.1 Flasks
1315.2 Molding Machines
1315.3 Stripping Machines
1315.4 Core Blowing
1315.5 Core Baking Ovens
1315.6 Dielectric Heating Furnaces
1315.7 Infra-Red Ray Heating Ovens

1321 Sand Handling Equipment
1321.1 Mullers
1321.2 Hoppers
1321.3 Sand Reclaiming Units

1325 Metal Pouring Equipment
1325.1 Molding Furnaces
1325.2 Bull ladles
1325.3 Shank ladles

1331 Shakeout Operation
1331.1 Mechanical Shakeout

1335 Heat Treating
1335.1 Furnaces
1335.2 Temperature Controls
1335.3 Atmosphere Controls

1341 Casting Cleaning Equipment
1341.1 Sand Blasting Equipment
1341.2 Hydroblasting Equipment
1341.3 Pickling Equipment
1341.4 Electrolytic Cleaning Equipment

1345 Material Handling Equipment
1345.1 Conveyors
1345.2 Monorails
1345.3 Mechanical Chargers for Cupola
1345.4 Cranes
1345.5 Lift Trucks

1351 Dust Control Equipment
1351.1 Centrifugal Dust Collectors
1351.2 Cloth Type Dust Collectors
1351.3 Wet Type Dust Collectors
1351.4 Fans & Exhausters
1351.5 Hoods & Piping

1355 Laboratory Testing Equipment
1355.1 Sand Testing Equipment
1355.2 Metallographic Equipment
1355.3 X-Ray Equipment
1355.4 Pressure Testing Equipment
1355.5 Physical Testing Equipment

1361 Casting Machines
1361.1 Die Casting
1361.2 Centrifugal Type Machine
1361.3 Precision Casting Machine
1361.4 Permanent Molding Machine

1365 Safety & Hygiene Facilities

1400 Foundry Costs

1500 Education

1501 General
1501.1 History
1501.3 Statistics
1501.4 Standards
1501.5 Books on Foundry Education

1505 Apprentice Training
1505.1 Pattern Shop
1505.2 Foundry

1511 Foreman Training

1515 College Training in Foundry Engineering

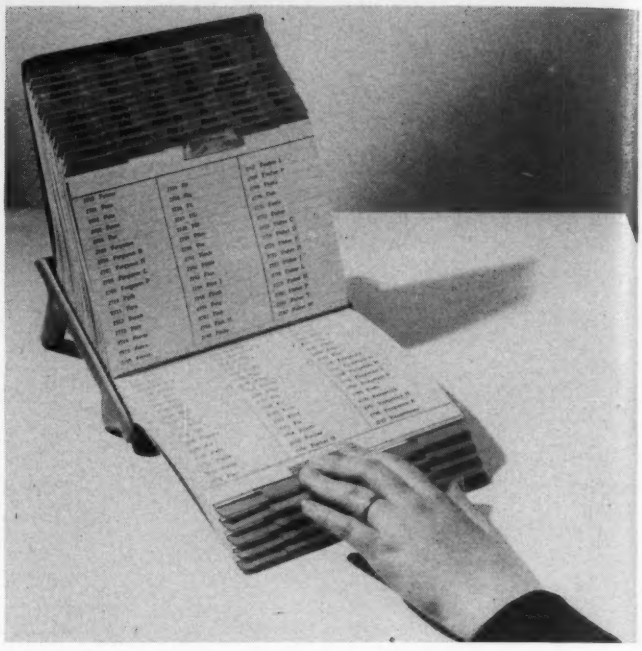
1600 Foundry Job Evaluation & Time Study

1601 General
1601.4 Standards
1601.5 Books on Job Analysis & Time Study

1605 Job Analysis
1605.1 Melting
1605.2 Molding
1605.3 Casting
1605.4 Cleaning
1605.5 Finishing
1605.6 Heat Treatment

1611 Time Study
1611.1 General
1611.4 Standards

1615 Pace Rating
1615.1 Melting Operations
1615.2 Molding Operations
1615.3 Casting Operations
1615.4 Cleaning Operations
1615.5 Finishing Operations
1615.6 Heat Treating Operations



Numerical name code index used for authors' names.

figure and not for any combination of 7, 4, 2 or 1.

The last two figures of the year the article was published ('48) would be punched also in the space assigned thereto on the card. Under units as provided under "Year" we would slot the digits 7 and 1 under units, both digits adding up to make 8. Then under tens we would slot digit 4.

At the bottom of the card we would punch the first letters of the authors' last names, namely, M, F and C. However, if we have access to a numerical name code index such as illustrated it would be well to use it instead. In this name code index names are assigned a code number which is punched on the card instead of the first letters of the author's last name. This will also eliminate many extraneous cards when sorting the cards by author.

Punching Method Described

Let us take another example: "A New Gating Technique For Magnesium Alloy Castings" by H. E. Elliott and J. G. Mezoff, TRANSACTIONS, American Foundrymen's Society, p. 241 (1947). The applicable code index number for this paper is 315.5 (*q.v.*). At the top of the card we punch out code index number 315.5, starting by punching the series number 3 (digits 2 and 1) under hundreds. Then we would punch digit 1 and SF under tens. Following that digits 4 and 1, which add up to 5 under units, would be punched, and similarly the 5 under tenths. At the bottom of the card, which is the author index, we would punch the letters E and M, the authors' last initials or the applicable numerical code index number. At the left-hand end of the card we would punch out digit 4 under tens, and digit 7 under units to indicate the year ('47) in which this technical paper was published. Should an error be made in punching or slotting a wrong digit the card can be salvaged by bridging the perforation or slot with mending tape. Then the card can be reslotted.

Many technical papers may require more than one indexing. For example, "Effect of Copper Addition Contaminants on Mechanical Properties of Gray Cast Iron" by K. E. Rose and C. H. Lorig, TRANSACTIONS, American Foundrymen's Society, vol. 55, pp. 89-101 (1947) should be classified under 641.1 and 641.53. Likewise, "Microstructure Related to Properties of Cast Iron" by W. E. Mahin and H. W. Lownie, Jr., TRANSACTIONS, American Foundrymen's Society, vol. 54, pp. 294-302 (1946) should be classified under 641.1 and 655.2, therefore requiring two separate punch cards.

It would be well to type a brief annotation or abstract of the article on the face of the cards. If an abstract or annotation appears in a publication it can be cut out and pasted firmly on the face of the card. The code number should also appear on the face of the card, preferably in the lower right-hand corner.

Sorting Reference Cards

These punch cards do not have to be filed in any particular order. However, it would be desirable to keep together cards of a given series, such as the 200 series cards dealing with aluminum, the 700 series dealing with steel, or any of the other series. To obtain required literature references on a given subject it is necessary to sort the cards. This is done by merely placing them in an upright position on a table as illustrated and supporting them with the left hand. A sorting needle or needles, which look like knitting needles, are next inserted in the holes corresponding to the applicable code index number. For example, if it is desired to obtain all references on fluxes and fluxing of magnesium alloys the cards would be sorted from the 300 series for number 311.5, the code index number for fluxing magnesium. An insertion of the sorting needle in a certain position will drop out all cards notched for that particular code index number. The time required for the hand sorting of 1000 cards would amount to several minutes.

To illustrate hand sorting for code index number 311.5, using a single needle; first grasp the 300 series cards with the left hand and support them on a table or desk. Insert the sorting needle through the hole above the digit 4 and then 1, which add up to 5. First insert the needle in the digit 4 hole, slightly fan out the stack of cards by moving the needle back and forth from left to right and then raising the needle until the slotted cards drop down. This technique is acquired only with practice. Then remove the needle from the cards which remained on the needle and set them to one side and further sort the cards which did not remain on the needle. Supporting these remaining cards in an upright position with the left hand, next insert the sorting needle in the digit 1 hole under tenths, fan out the cards slightly and raise the needle, thereby dropping the cards which were slotted for this number. This same technique is repeated for digit 1 and SF under units, digit 1 and SF under tens, and digits 2 and 1 which equal 3 under hundreds. The cards which drop out after the final sorting are the applicable reference cards.

By using as many needles as holes to be sorted through, the manual sorting operation time can be reduced by at least half. In the foregoing illustration eight needles would be required for sorting.

The sorting operation can be facilitated still further by using a fixture or selector on which the cards are stacked and inserting as many needles as are necessary into the classifying holes. Upon inverting this fixture or selector the desired cards drop out while the unpunched cards remain on the needles. The mechanism of manual sequence sorting is identical with that employed in direct or selector sorting.

Acknowledgment

Acknowledgment is made to Charles Locke, Armour Research Foundation, Chicago, for his assistance in establishing the code, and to the McBee Co., Athens, Ohio, for the illustrations used in the paper.

Bibliography

1. G. J. Cox, C. F. Bailey and R. S. Casey, "Punch Cards for Chemical Bibliography," *Chemical and Engineering News*, vol. 23, no. 18, Sept. 25, 1945, pp. 1623-6.

2. W. J. Eckert, "Punched-card Techniques and Their Application to Scientific Problems," *Journal of Chemical Education*, vol. 24, Feb., 1947, pp. 54-7.

3. G. W. King, "Some Applications of Punched Card Methods to Research Problems in Chemical Physics," *Journal of Chemical Education*, vol. 24, Feb., 1947, pp. 61-4.

4. A. G. Guy and A. H. Geisler, "A Punch Card Filing System for Metallurgical Literature," *Metal Progress*, vol. 52, no. 6, Dec. 1947, pp. 993-1000.

5. J. H. Westbrook and L. H. DeWald, "A Modern Punch Card Filing System for Metallurgical Literature," *Metal Progress*, vol. 54, no. 3, Sept., 1948, pp. 324-7.

6. Lorna Ferris, Kanardy Taylor, and J. W. Perry, *Bibliography on the Uses of Punched Cards*, American Chemical Society, Washington, D.C.

FOUNDRIES Exhibit At Wisconsin Fair

F. M. Jacobs
Standard Brass Works
Milwaukee, Wis.

VIEWED BY MORE THAN A MILLION PEOPLE, the 2000 square foot foundry industry exhibit was one of the highlights of the "Wisconsin at Work" building at the Wisconsin Centennial Exhibition, held in Milwaukee during the month of August.

Contrasting old and modern methods of casting production, the exhibit showed interested crowds why "The Foundry is a *Good* Place to Work." The audience watched molders and coremakers perform operations, first by the old, slow, tiresome methods, and then by the modern, rapid, effortless methods.

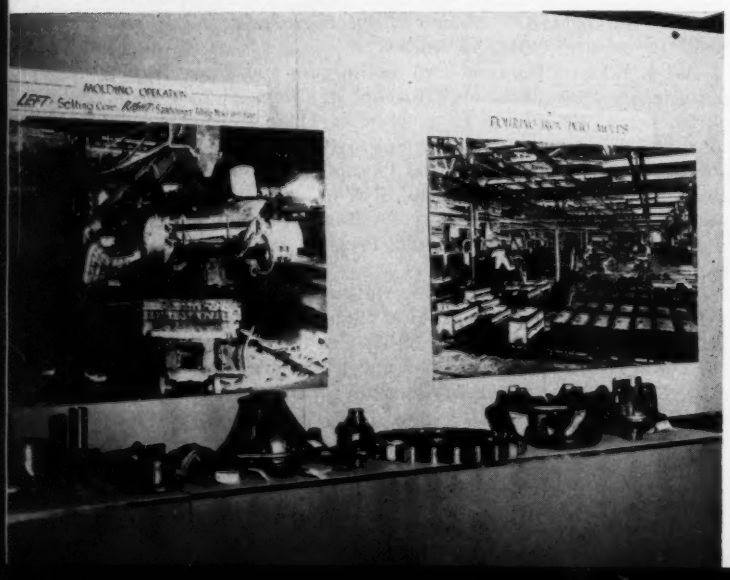
A lifesize model ladle and furnace spout, rigged with lights, oil, and dry ice, simulated the tapping of a furnace. Eight huge murals of foundries at work, showing pouring, cleaning, gating and risering, welding, and large mold pouring made up the background of the exhibit. A large variety of iron, steel, and non-ferrous castings, some a century old and some brand new, were on display for the visitors to examine.

To explain the workings of the exhibit, foundrymen using a public address system explained operations, and pointed out the physical labor saving that is accomplished through modern foundry methods.

Audiences stood five and six deep at the exhibit, intently watching the demonstrations and listening attentively as the loudspeaker, manned by foundrymen from all over Wisconsin, explained foundry work.

Left: the old-fashioned method of bench coremaking by hand as demonstrated at the Centennial exhibit. Right: making cores with coreblowing machine.

Some of the many castings exhibited by Wisconsin foundries at the State's Centennial Exposition. In background are two of eight photographic murals showing principal phases of modern foundry operations.



The demonstration started with bench molding using a loose pattern, hard sand match, and snap flask. Then the same casting was molded two in a flask using a matchplate and a jolt-squeeze machine with conditioned sand sliding into the flask from a pneumatically controlled hopper. On completion of molding, the unpoured molds were moved on a roll conveyor to a shakeout area where they were dumped. The sand travelled on a belt into a sand mixer from which, after retempering, it was elevated into the molding hopper.

The difference between making cores one at a time by hand and four at a time by machine was shown in the last part of the demonstration. The audience watched a coremaker tuck sand into a single split wooden core box held together by a "C" clamp; then contrasted this with the ease and speed of core production using a four-gang aluminum core box and a core blower.

Sponsored by officers of the A.F.S. Wisconsin chapter, the success of the exhibit is largely due to the efforts of three men—R. J. Anderson, Belle City Malleable Iron Co., Racine, general chairman; James J. Ewens, Grede Foundries, Inc., Milwaukee, chairman of display and operation; and George E. Tisdale, Zenith Foundry Co., West Allis, who as finance chairman en-

listed the backing of 54 Wisconsin foundries, who contributed two dollars per employee to defray costs.

The sponsoring companies and their cities are:

Beaver Dam: Kirsch Foundry Co., Malleable Iron Range Co.

Beloit: Beloit Iron Works.

Brillion: Brillion Iron Works.

Cedar Grove: State Foundry & Machine Co.

Manitowoc: Wisconsin Aluminum Foundry Co.

Neenah: Neenah Foundry Co.

Oshkosh: Universal Foundry Co.

Fort Atkinson: James Mfg. Co.

Kohler: Kohler Company.

Milwaukee: Allis Foundry Products Co., Ampco Metals, Inc.; Badger Brass & Aluminum Foundry Co., Chain Belt Co., Crucible Steel Castings Co., Falk Corp., General Foundries Co., Nordberg Mfg. Co., Harnischfeger Corp., Koehring Co., Loeffelholz Co., Maynard Electric Steel Castings Co., Mid-City Foundry Co., Milwaukee Aluminum and Brass Co., Milwaukee Malleable & Gray Iron Works, Inc., Pelton Steel Casting Co., R. Perlick Brass Co., Rundle Mfg. Co., Sivyer Steel Casting Co., Standard Brass Works, Wehr Steel Co.

Port Washington: J. E. Gibson Co.

Racine: American Skein & Foundry Co., Belle City Malleable Iron Co., J. I. Case Co., Iroquois Fdry. Co., Lakeside Malleable Castings Co., Standard Foundry Co.

South Milwaukee: Badger Malleable & Mfg. Co., Lake Aluminum Products Co., Wis. Appleton Co.

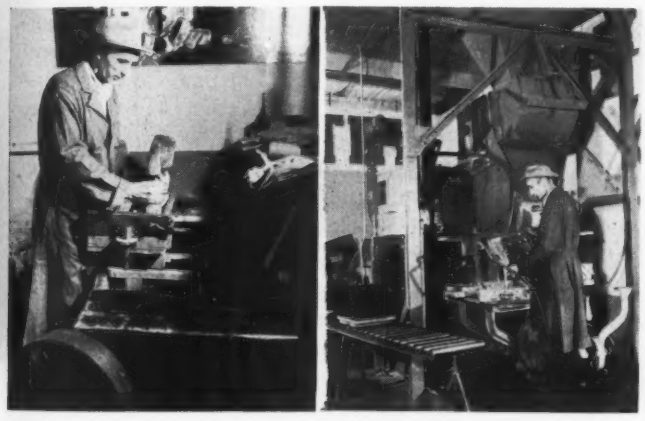
Waukesha: General Aluminum & Gray Iron Foundry Div. of General Malleable Corp., Spring City Div. of Grede Foundries, Inc., Quality Aluminum Casting Co., National Aluminum Co., Waukesha Foundry Co.

Wausau: D. T. Murray Mfg. Co.

West Allis: Allis-Chalmers Mfg. Co., Allis Machine & Foundry Co., Federal Malleable Co., Lawran Foundry Co., Motor Casting Co., Zenith Foundry Co.

Two Rivers: Becker Mfg. Co.

The effort of these three men contributed largely to the success of the exhibit. Left to right: Finance Chairman George E. Tisdale, Zenith Foundry Co., West Allis; James J. Ewens, Grede Foundries, Milwaukee, display and operation chairman; and R. J. Anderson, Belle City Malleable Iron Co., Racine, gen'l chairman.



Left: bench molding using the loose-pattern method. Right: molding with a modern jolt-squeeze machine.

This exhibit of the Belle City Malleable Iron and Racine Steel Castings Companies featured a life-sized model of a furnace being tapped at a recent Industry Fair, held by Racine, Wis., manufacturers in commemoration of the State's Centennial Celebration. Some 50,000 persons who visited the exhibit examined the wide variety of castings manufactured by the two companies.

NOVEMBER 4-5 CASTING CONFERENCE PROGRAM

APPROXIMATELY 300 FOUNDRYMEN are expected to attend the Metals Casting Conference to be held November 4 and 5 at Purdue University, Lafayette, Ind., according to Conference Chairman C. T. Marek, assistant professor of engineering shop practice. Planned in cooperation with the Central Indiana and Michiana chapters of A.F.S., the conference features general group sessions the first day, and separate technical sessions for ferrous and non-ferrous foundrymen the second day. Subject matter covers topics of interest to top management, supervisory personnel, and all others interested in production and use of castings.

The first days' sessions are on quality control, foundry mechanization, and foundry personnel problems. Principal speaker at the banquet the evening of November 4 will be Dr. Frank Sparks, president of Wabash College, who will talk on industry and education relationships. He will be introduced by Purdue President Frederick L. Hovde; Paul H. Harlan, vice-president of Electric Steel Castings Co., Indianapolis, Ind., will preside. In addition to discussing how industry and education can best work together, Dr. Sparks will comment on industrial and educational conditions in Europe as he observed them on a recent trip abroad.

Officers of student engineering societies will attend the banquet as guests of the foundrymen.

The second day of the conference will include sessions on best use of raw materials in melting for both ferrous and non-ferrous foundrymen, a meeting on casting procurement, and a tour of the university. The meetings on raw materials and melting will start with a general talk on common problems followed by speakers representing the various branches of the foundry industry. A round table discussion will follow the talks.

Cost of the conference is $3.00 (second day only, $1.50). Reservations for banquet tickets, $2.00, must be made by Monday, November 1. All checks should be made payable to Purdue University. Overnight reservations can be made by contacting the Purdue Union Club, or the Fowler or Lahr Hotels.

Planning the Metals Casting Conference, in addition to Chairman Marek are: Conference Secretary R. W. Lindley, chairman, engineering shops, Purdue University; Mr. Harlan; F. T. McGuire, foundry manager, Sibley Machine & Foundry Corp., South Bend, Ind.; M. M. McClure, Purdue technical extension division; H. A. Bolz, head, department of general engineering; and G. M. Enos, professor of metallurgical engineering. The program announced by the Conference Committee is:

Thursday, November 4

9:30 a.m.—REGISTRATION. Lobby, Purdue Memorial Union.

10:30 a.m.—WELCOME ADDRESS. Faculty Lounge, Purdue Memorial Union. *Presiding,* Professor H. A. Bolz, head, department of general engineering. *Speaker,* Dr. A. A. Potter, dean of engineering.

11:00 a.m.—QUALITY CONTROL. Faculty Lounge. *Presiding,* Dallas F. Lunsford, chief metallurgist, Perfect Circle Corp., New Castle, Ind.

"Quality Control for the Practical Foundryman," Dr. I. W. Burr, industrial consultant and associate professor of mathematics, Purdue.

1:30 p.m.—FOUNDRY MECHANIZATION. Faculty Lounge. *Presiding,* Beauford E. Gavin, assistant manager, National Malleable & Steel Castings Co.

"Better Labor Relations by Mechanization," B. L. Simpson, president, National Engineering Co.,

"New Foundry Horizons," motion picture showing modern casting production in a mechanized jobbing foundry. Commentary by R. L. McIlvaine, vice-president and sales manager, National Engineering Co., Chicago.

3:15 p.m.—FOUNDRY PERSONNEL PROBLEMS. Faculty Lounge. *Presiding,* Dr. R. W. Field, associate professor of industrial engineering, Purdue.

"Labor Procurement," Joe H. Ayres, supervisor of employment and insurance, Armco Steel Corp., Middletown, Ohio.

"Labor Training," James G. Purvis, supervisor of training, Armco Steel Corp.

"The Personal Element in Employee Relations," Ralph L. Lee, department of public relations, General Motors Corp., Detroit.

6:30 p.m.—BANQUET. South Ballroom, Purdue Memorial Union. *Presiding,* Paul H. Harlan, vice-president, Electric Steel Castings Co., Indianapolis. *Introduction,* Dr. Frederick L. Hovde, president, Purdue University.

"Relation Between Industry and Education," Dr. Frank Sparks, president, Wabash College.

Friday, November 5

10:00 a.m.—FERROUS METAL DIVISION. Eliza Fowler Hall. *Presiding,* F. T. McGuire, foundry manager, Sibley Machine & Foundry Corp., South Bend, Ind.

"Making Best Use of Raw Materials in Melting," R. G. McElwee, manager, iron foundry division, Vanadium Corp. of America, Detroit. Supporting speakers: *gray iron,* R. H. Bancroft, plant manager, New Castle plant of Perfect Circle Corp., New Castle, Ind.; *malleable iron,* William Ferrel, general works superintendent, Auto Specialties Mfg. Co., St. Joseph, Mich.; *steel,* G. C. Dickey, works manager, Harrison Steel Castings Co., Attica, Ind.

10:00 a.m.—NON-FERROUS METAL DIVISION. Faculty Lounge, Purdue Memorial Union. *Presiding,* V. S. Spears, American Wheelabrator and Equipment Corp., Mishawaka, Ind.

"Making Best Use of Raw Materials in Melting," Hiram Brown, chief metallurgist, Solar Aircraft Co., Des Moines, Iowa. Supporting speakers: *light metals,* A. T. Ruppe, foundry superintendent, Bendix products division, Bendix Aircraft Corp., South Bend; *brass and bronze,* R. Langsenkamp, secretary, Langsenkamp-Wheeler Brass Works, Indianapolis.

12:15 p.m.—LUNCH HOUR.

1:30 p.m.—CASTING PROCUREMENT. Eliza Fowler Hall. *Presiding,* Dr. G. M. Enos, professor of metallurgical engineering, Purdue University.

"The Purchaser Expects from the Foundry—What and Why?" Ben G. Thiel, purchasing engineer, Waukesha Motor Co., Waukesha, Wis.

3:00 p.m.—TOUR OF THE UNIVERSITY.

Announce Committee Chairmen For Ohio Regional Foundry Conference

COMMITTEE CHAIRMEN AND VICE-CHAIRMEN for the second Ohio Regional Foundry Conference have been announced by General Conference Chairman D. C. Williams, assistant professor, department of industrial engineering, Ohio State University, Columbus. Based on the theme "New Developments for the Operating Foundryman," the conference will be held March 11 and 12, 1949, at Ohio State. The five Ohio chapters of A.F.S., the University, and the Ohio State University Student Chapter of A.F.S. are working together to make the conference a success.

The Program Committee is headed by Dan E. Krause, Gray Iron Research Institute, Columbus, assisted by the following vice-chairmen representing the five Ohio chapters; N. J. Dunbeck, Eastern Clay Products, Inc., Jackson; Alexander E. Barczak, Superior Foundry, Inc., Cleveland; H. G. Schwab, Bunting Brass and Bronze Co., Toledo; C. F. Bunting, Pitcairn Co., Barberton; and Fred Pharr, Forest City Foundry, Cleveland.

Chairman and vice-chairman, respectively, of registration are Fred W. Fuller, National Engineering Co., Westerville, and Kenneth McGrath, Altens Foundry & Machine Co., Lancaster.

The Housing, Dinners, and Luncheons Committee is headed by Walter L. Deutsch, Columbus Malleable Iron Co. E. M. Durstine, Keener Sand and Clay Co., also of Columbus, is vice-chairman.

W. T. Bland, Commercial Steel Castings Co., Marion, chairman of the Finance Committee, will be assisted by vice-chairman J. J. Witenhafer, Columbus Malleable Iron Co., and R. A. Willey, Commercial Steel Castings Co.

Chairman of the Publicity Committee is J. G. Lummis, A. P. Green Firebrick Co.; vice-chairmen are C. T. Greenedge, Battelle Memorial Institute, and Karol Whitlach, all of Columbus.

Philadelphia A.F.S. Chapter Sponsors Elementary Foundry Practice Course

A 20-WEEK FOUNDRY COURSE, "open to all ambitious men in the foundry industry who wish to broaden their knowledge of foundry practice," began September 27 at the Murrell-Dobbins Vocational Technical School, under the sponsorship of the Philadelphia Chapter of the American Foundrymen's Society.

The course is the work of the Chapter's Educational Committee, headed by A. C. Gocher, Fletcher Works, and Co-Chairman B. A. Miller, Baldwin Locomotive Works, in cooperation with J. Norwood Baker, principal, and John J. L. Gross, coordinator, of the Murrell-Dobbins School. Speakers and their topics scheduled for the 20-week course are:

October 4—*"Engineering Application of Castings,"* F. G. Sefing, International Nickel Co., New York.

October 11—*"The Drawing and the Pattern,"* Joseph Hager, Baldwin Locomotive Works, Eddystone, Ja.

October 18—*"Sands for Molding,"* C. L. Lane, Florence Pipe Foundry & Machine Co., Florence, N.J.

October 25—*"Binders—Their Properties and Uses,"* C. L. Lane, Florence Pipe Foundry & Machine Co., Florence, N.J.

November 1—*"Sand Compounding, Testing and Controls,"* C. L. Lane, Florence Pipe Foundry & Machine Co., Florence, N.J.

November 8—*"Molding Methods,"* Arthur A. Thum, Palmyra Foundry Co., Palmyra, N.J.

November 15—*"Cores,"* Joseph Avylla, Philadelphia Naval Shipyard.

November 22—*"Melting Methods, Fuels, Refractories—Cast Iron and Malleable Iron,"* J. S. Vanick, International Nickel Co.

November 29—*"Melting Methods, Fuels, Refractories—Brass and Bronze, Light Metals,"* R. J. Keeley, Ajax Metal Co., Philadelphia, and G. H. Bradshaw, Philadelphia Naval Shipyard.

December 6—*"Melting Methods, Fuels, Refractories—Steel,"* E. H. Berry, Jr., Dodge Steel Co., Philadelphia.

December 13—*"Pouring and Solidification of Metals,"* Prof. Howard Taylor, Massachusetts Institute of Technology, Boston. Alternate: E. C. Troy, Foundry Engineer, Philadelphia.

January 10—*"Cleaning and Finishing of Castings,"* C. B. Somers and Fred Mosley, Whitehead Bros. Co., New York.

January 17—*"Analysis of Casting Defects,"* F. G. Sefing, International Nickel Co., New York. Alternate: E. C. Troy, Foundry Engineer, Philadelphia.

January 24—*"Inspection Methods,"* J. W. Juppenlatz, Lebanon Steel Foundry, Lebanon, Pa.

January 31—*"Heat Treament of Castings,"* C. B. Jenni, General Steel Casting Co., Eddystone, Pa.

February 7—*"Safety and Good Housekeeping,"* Louis H. Kite, Florence Pipe Foundry & Machine Co., Florence, N.J.

February 14—*"The Foundry Organization,"* W. A. Morley, Olney Foundry, Philadelphia.

February 21—*"Future of the Foundry Industry,"* A.F.S. Past National President Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.

Ontario Chapter Educational Course Covers Variety of Foundry Subjects

A TOTAL OF 24 LECTURES, covering the principal phases of the foundry industry, are scheduled for presentation at the Hamilton Technical School, Hamilton, Ont., under sponsorship of the Ontario Chapter of the American Foundrymen's Society, according to Chapter Educational Chairman R. H. Williams of Canadian Westinghouse Co., Ltd.

Three lectures will be presented on each of eight subjects, under the leadership of W. Jones, Canadian Westinghouse Co., Ltd., course instructor and discussion leader. Concurrently with the lectures, a molding course is being presented by T. Hewitt, Canadian Westinghouse Co., Ltd. Lectures scheduled are:

October 7, 14, 21—*"Molding Sands,"* W. Jones, Canadian Westinghouse Co., Ltd.

October 28, November 4, 11—*"Core Sands and Cores,"* H. Fairfield, Wm. Kennedy & Sons.

November 18, 25, December 2—*"Patterns,"* A. Raeburn, Massey-Harris Co., Ltd..

December 9, 16, January 6—*"Molding,"* R. Robertson, International Harvester Co.

January 13, 20, 27—*"Non-Ferrous Metallurgy,"* F. Diana, Z. Wagman & Sons, Ltd.

February 3, 10, 17—*"Cupola Operations,"* R. Vollick, Canadian Westinghouse Co., Ltd.

February 24, March 3, 10—*"Iron Metallurgy and Control,"* R. Short, McKinnon Industries, Ltd.

March 17, 24, 31—*"Casting Defects,"* W. Jones.

Detroit Chapter Publishes Directory

A DIRECTORY OF MEMBERSHIP of the Detroit Chapter of the American Foundrymen's Society for 1948-49 has recently been published by the Chapter. Comprising 56 pages, the Directory lists names and addresses of both company and individual members, together with officers, directors, honorary life members, and sustaining members. The Directory is cross-indexed by company affiliation, and contains Chapter by-laws.

GRAY IRON FOUNDRY DEVELOPS RESIN CORE MIXTURES

T. W. Curry
and
H. E. Henderson
Lynchburg Foundry Co.
Lynchburg, Va.

IT HAS BEEN KNOWN to the foundry industry for a number of years that various synthetic resins may be used as binders for cores. However, for a number of reasons these resins were not adaptable for widespread use in core production, the main reasons being the high cost of synthetic resins and their natural stickiness which makes release from the core box difficult.

During the last war the non-ferrous branch of the foundry industry began to experiment with synthetic resin mixtures for cores. Although the core mixtures developed were somewhat sticky, the need for a more collapsible core forced these foundries into using resin bonded core mixtures.

Synthetic resin cores bake more rapidly than conventional cores bonded with oil. Faster baking time at lower temperatures produces more cores per oven, resulting in lower installation and maintenance costs, or allows the use of a finer sand, resulting in a better casting surface, for the same oven space. This, in addition to the benefits gained in the molding sand system, made the resin core mixture very attractive to the gray iron foundries.

As early as March, 1945, experimental work was begun with synthetic resins. The results of these experiments showed the inherent possibilities of synthetic resins as core binders. A 60 per cent reduction in baking time was achieved and other core properties were improved, but the mixture could not be used in production due to poor workability in the core boxes.

By the early part of 1947, the authors' foundry had been operating with chemically treated molding sand for a few months and it was becoming more and more apparent that the infiltration of collapsed oil core sand in the system was detrimental. By September, 1947, this fact was of such importance that a concentrated program was set up to attempt to correct, or compensate for, the sticking characteristics of the resin core sand mixture on the assumption that the collapsed resin core sand would not be detrimental to the chemically treated molding sand.

During the experimental work to adapt the chemically treated molding sand process to practical use in the shops, it was found that No. 10M molding sand (Table 1) had especially desirable characteristics when chemically treated. This sand, when used in the resin core mixtures, reduced stickiness and improved workability to an extent where the core mixture was sufficiently practicable for a trial shop run. It also demon-

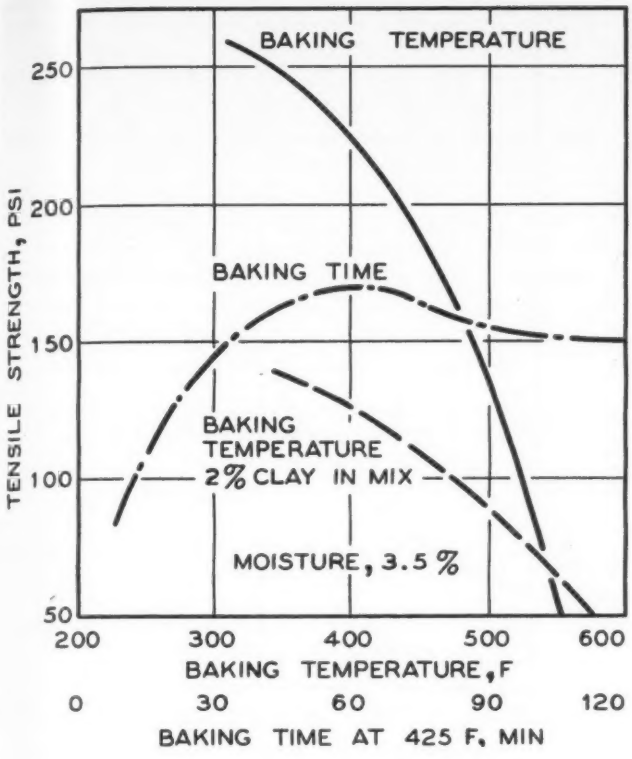
TABLE 1—AVERAGE SCREEN ANALYSIS OF FOUNDRY SANDS USED

Sieve No.	Remaining on Screen, Per Cent							
	No. 10.M	No. 111	No. 40	Grade A	No. 60	Grade C	No. 90	Grade E
6	0.0	0.0	0.0	0.0	0 0	Trace	0.0	Trace
12	0.0	Trace	0.0	0.0	0.0	Trace	0.0	Trace
20	Trace	Trace	Trace	Trace	Trace	Trace	0.0	Trace
30	0.4	Trace	3.2	3.0	1.6	0.6	0.0	Trace
40	2.8	Trace	14.4	14.0	8.0	5.2	Trace	Trace
50	5.2	Trace	34.4	31.8	19.8	20.6	Trace	1.0
70	14.6	3.0	36.0	35.0	36.4	44.0	5.6	7.6
100	24.4	24.0	11.0	14.0	21.2	26.2	41.5	44.0
140	16.6	44.6	Trace	1.6	8.2	3.2	36.1	26.0
200	14.0	22.8	Trace	Trace	3.4	Trace	13.5	13.4
270	4.2	2.8	Trace	Trace	0 8	Trace	2.4	4.2
Pan	5.6	1.0	0.0	0.0	0.4	Trace	0.4	5.0
Total	87.8	98.2	99.0	99.4	99.8	99.8	99.5	101.2
A.F.S. Fineness No.	105	103	44	50	59	54	93	103
A.F.S. Clay	12.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0

Chemical Analysis of No. 10-M Sand, Per Cent

Loss on ignition	1.80	Calcium oxide	0.27
Silica	87.78	Magnesium oxide	0.53
Alumina	3.16	Sodium oxide	0.11
Iron oxide	5.92	Potassium oxide	0.32

NOTE: All sands shown in Table I are mined and shipped from the New Jersey area.



Graph 1—Baking time and temperature effect on tensile strength of a resin core. There is little tendency to overbake at 425 F, but at higher temperatures overbaking becomes a serious problem. Note effect of 2 per cent clay content on the tensile strengths.

strated that the resin core mixtures had possibilities in our core room and offered proof that some procedure to use the resin binders could be found.

However, the elimination of the sticking characteristics was accomplished with a great sacrifice in baked strength (Graphs 1 and 2) and the problem then was to find a way to increase the baked strength without increasing the stickiness. At this point we found the tremendous influence of the moisture content of the core sand mixture on the baked strength (Graph 3) and the problem resolved into a balance between moisture content, resin content for strength, and clay content to reduce sticking. In order to have a workable mixture, the clay content was such that insufficient surface hardness could be obtained. This was overcome by spraying the green cores with water, which developed a surface hardness of 100 and over in the baked core.

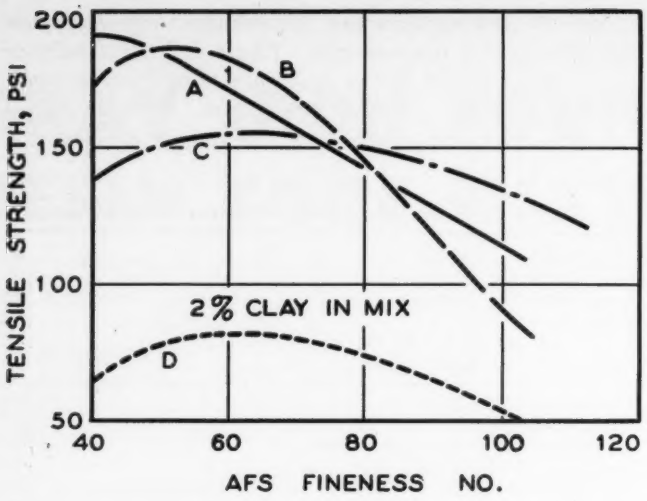
TABLE 2—CORE MIXTURE "A" AND PROPERTIES

Silica Sand No. 60, qt	65
Silica Sand No. 90, qt	25
Bank Sand No. 10M, qt	12
Corn Flour, qt	3
Resin "D" (see Table 3), lb	3
Resin "B" (see Table 3), lb	3
Moisture, per cent	5–5½
Green Strength, psi	1.2
Deformation, in./2-in. specimen	0.030
Samples Baked at 400F, min	45
Dry Permeability	105
Dry Compression	282+
Tensile Strength, psi	80
Surface Hardness	80/90
Water Sprayed Surface Hardness	100+

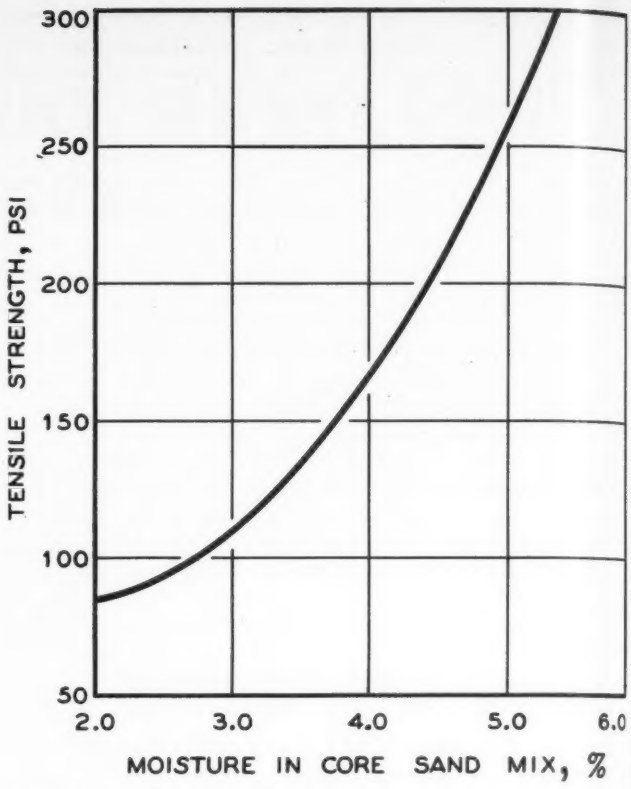
By December, 1947, we were ready to go into limited production with mixture "A" shown in Table 2. The cores made from mixture "A" were sprayed in the green state with water and baked at 450 F. The baking time was approximately half that of a corresponding oil core.

Mixture "A" was only slightly sticky and could be worked in production. We were planning to go into

Bench coremaking operation for small cores. Cores are moved to core oven by continuous belt conveyor. Note the wide range of sizes and shapes of cores.



Graph 2—Sand grain fineness effect on baked tensile strength of resin core. Mixes A, B and C are the same except in grain distribution. Mix A has greatest screen distribution and Mix C least. Note effect of 2 per cent clay content on the tensile strength (Graph 1).



Graph 3—Moisture effect on baked tensile strength of a resin core. Moisture content of the resin core mix has more effect on tensile strength of the baked core than any other factor provided the optimum baking temperature of the mixture is not exceeded (Graph 1).

partial production with this mixture, even though the cost was 1½ times that of an oil core mixture, because of the savings in core baking time and the advantages to be gained in the chemically treated sand system.

Mixture "A" is definitely limited in shop application because of the high moisture content and the low tensile strength. The high moisture required produced an unsuitable mixture for blowing due to poor flowability and stickiness in the blower magazine and core boxes. Low baked tensile strengths developed limited this mixture to cores which did not require lifting into the mold with hooks or otherwise placing the core weight on a small cross-sectional area of the core.

The limitations and high cost of this resin core mixture led to investigations of the resin core projects of other foundries in the gray iron field. There seemed to be considerable interest but little success with resin cores in most foundries. Our attention was drawn to a new water-soluble phenol-formaldehyde liquid resin being investigated by the Ford Motor Co., Dearborn, Mich. A resin core mixture, less expensive than our oil sand mixtures, with baked tensile strengths of over 200 psi and a minimum of sticking could be made with 0.5 per cent liquid phenol-formaldehyde resin, 2 per cent cereal binder, 4 per cent moisture, and silica sand.

General conclusions from the gray iron foundries investigating resin cores may be summarized as follows:

1. The application of resin bonded cores is dependent upon the elimination of sticking characteristics.

2. The best solution found to prevent sticking is a soap solution. The procedure is to apply the soap solution, clean the core box with water, and dry. No soap solution can be left on the box surface or the sand will stick to the core box.

3. All experimental procedure pointed toward a resin content of 0.5 per cent as being the best for hardness, strength, lack of sticking, ability to blow, and general good workability. Resin content in excess of 0.5 per cent makes the resin core mixture more expensive than an oil core mixture.

4. Strike-off tools should have a sharp edge to cut the sand. This is better than rubbing off with a square-edged tool. Divide the surface at the joint of a core into equal sections; cut one half and then cut the second half in the opposite direction from the first operation.

5. The surface of a green core may be fogged with water, or glutrin-water vapor, to develop a harder core surface and promote migration of resin to the surface.

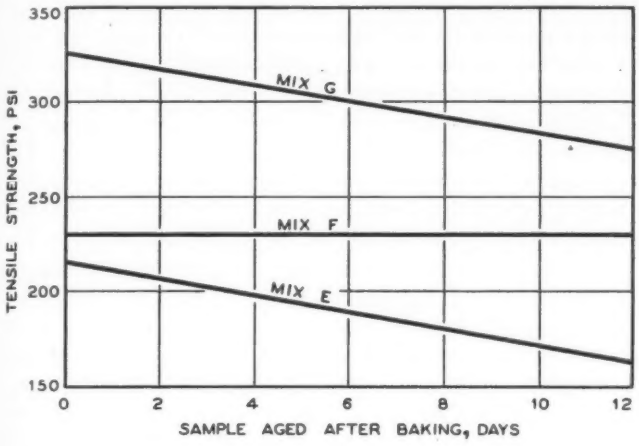
Large core assembly for transmission case casting being placed in slinger mold unit. This assembly consists of resin core topped with green molding-system sand. The entire assembly is picked up by hooking into two holes in print of resin core. The resin core must have sufficient strength to support entire assembly weight.

6. Resin core mixtures may be mixed in either a muller or a paddle type mixer. However, the green and baked properties of a mixture are affected by both the type of mixer and the mixing procedure.

7. Core collapsibility varies with the type of resin used, but generally a resin core mixture has better collapsibility than an oil core mixture.

8. The baked strength of resin bonded cores is sufficiently high to allow elimination of core arbors in a cylinder barrel core application, but it is drastically reduced with an introduction of clay in the mixture.

9. Resin core mixtures, generally, require at least 4 per cent moisture for maximum strength.



Graph 4—Aging effect on baked tensile strength of resin core. Mix E contains straight resin mix with 1 per cent resin. Mix F contains 1 per cent resin and 2 per cent combination green and dry binder. Mix G contains 1 per cent resin and 1¼ per cent dextrine.

10. Liquid resins deteriorate with age. Properties are adversely affected after three months storage at room temperature. Arrangements should be made to change inventory stock at some regular period and to use the oldest resin first at all times.

A procedure was set up in our laboratory for evaluating any new resin that might be developed. Since that time we have tested seven different resins and have several more in the laboratory to be tested. The mixing procedure and core mixture used is as follows:

Test Mixture: 40 lb of 60 A.F.S. Fineness silica sand and 91 grams of resin are placed in laboratory muller "B" and mulled one minute, or until the sand glistens. Then 725 ml of water, to bring the moisture up to 4 per cent, are added and mulling continued for ½ minute. After adding 363 grams of corn flour and mixing for 3 minutes (mixture at this stage will appear sticky) add 54½ ml of fuel oil, mix for 10 seconds, and discharge immediately.

Resin core for transmission case casting being checked for "sag." This core has been sprayed green with 15° Baumé blacking solution. Weight of core is 84 lb.

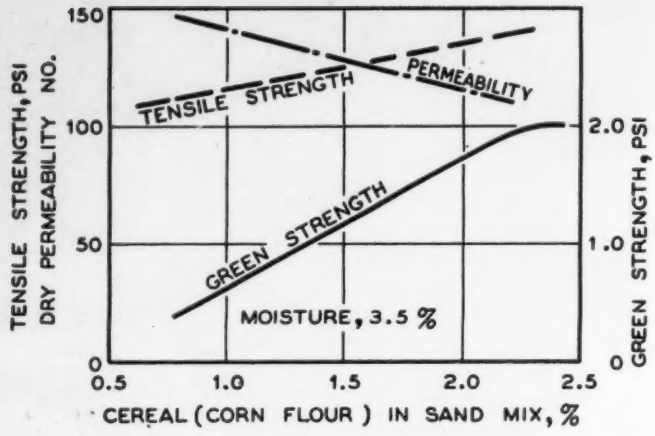
Green properties of the mixture are measured and samples for baking rammed up immediately. Samples are baked at 400 F in a revolving laboratory oven for 30, 45, and 60 minutes. The baked samples are tested as soon as they cool to room temperature. If the samples are aged over 12 hours they will lose strength (Graph 4). Table 3 shows comparative evaluations of the resins tested in the plant laboratory.

Table 3 shows that there are several resins which develop sufficient baked tensile strength to warrant their use in core production. The problem then resolves into one of economics and adaptability to plant practice. Some of the resins give off undesirable fumes in baking, at the pour-off, and at the shakeout. Powdered resins have the advantage of longer storage life without refrigeration, but the disadvantage of requiring dry sand for thorough mixing. There does not seem to be any great difference in the stickiness of any of these resins if they are mixed as stated.

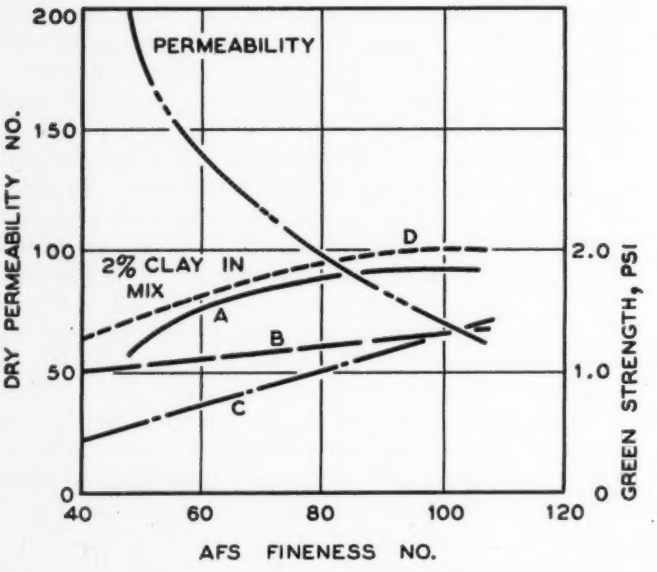
Some of these resins have the disadvantage of requiring a catalyst to start the reaction. This requires added control in that a chemical solution must be made to exact proportions, and this is difficult to attain in shop practice. It is possible that a mixture of two or more of these resins may prove more successful than any of them alone. This is a research program that

TABLE 3—EVALUATION OF VARIOUS RESINS TESTED

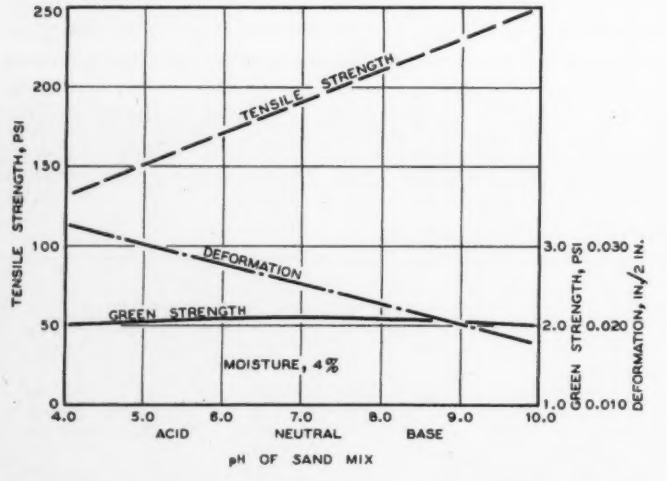
Resin	Type	Moisture, per cent	Green Strength, psi	Deformation, in./2 in.	Samples Baked at 400F: Tensile Strength, psi 30 min	45 min	60 min	Surface Hardness 30 min	45 min	60 min
A	Liquid Phenolic	4.1	1.2	0.035	160	177	143	70/90	85/100	85/100
B	Liquid Phenolic	3.8	1.2	0.035	111	113	111	75/90	80/90	75/90
C	Powdered Phenolic	3.9	1.5	0.050	70	77	66	60/70	50/60	50/60
D	Powdered Urea	4.2	1.2	0.040	117	90	88	70/90	70/90	70/80
E	Powder	4.0	1.8	0.053	100	95	93	80/90	80/90	80/90
F	Powdered Urea	4.1	2.0	0.022	90	77	86	80/90	80/90	85/90
G	Powdered Phenolic	3.9	2.3	0.026	120	122	116	80/90	80/90	80/90



Graph 5—Increasing cereal content effect on physical properties. Additions in excess of 2 per cent tend to increase stickiness and decrease flowability.



Graph 6—Sand fineness effect on dry permeability and green strength (Graph 2 for mixes A, B and C).



Graph 7—Effect of pH on baked tensile strength of resin core. Stickiness increases as pH increases—best working properties were in the range of pH6 to pH7.

would require time to develop, and we selected the best resin for our purpose and concentrated on getting a resin core mixture into production. We selected a liquid phenol-formaldehyde resin for its superior baked tensile strength and surface hardness. These two properties are of most importance in our shop since most of our cores have to be surface ground at the joint, and some of them must be lifted into the mold carrying a green sand top.

The results obtained with the test mixture and close observations of stickiness and workability in the laboratory allow us to predict the performance of a resin in shop application. This enables us to discard resins unsuitable for our plant practice and to establish baking time, temperature, and procedure for plant tests on suitable resin core mixtures.

Our first resin mixture in the shop, on Jan. 22, 1948, presented another problem—mixing. By using the laboratory mixture and procedure for a larger batch in shop muller "C," we did not obtain the same green properties as in the laboratory. In fact, we came out with a mixture too stiff to ram. By adjusting the mixture we established the best working range to be 1¼ per cent corn flour by weight. This gave a mixture with a green strength of 1.5 to 1.8 psi and fairly good ramming qualities.

Cores were made for a small transmission case and a large transmission case. These cores baked in one cycle of the tower oven, whereas the same cores made from our oil sand mixture required two cycles of the oven for complete baking. The resin cores were sprayed green with water and came out of the oven with a surface hardness of 100. Castings made from these cores had an exceptionally good finish on the cored surface and a very small amount of veining. There was no evidence of other casting defects that could be attributed to the resin core.

It was necessary to bring the resin mixture back into the laboratory and study the effect of various ingredients on the properties of the mixture before going into production in the shop. From numerous mixtures in the laboratory, we were able to establish and confirm by shop production the following:

1. The moisture content of the resin mixture is probably the most important single factor influencing the baked strength and surface hardness of the core if baked at a temperature not exceeding 450 F (Graph 3).

2. Clay content, whether introduced by a bank sand or a bentonite, in the range of 2 per cent clay in the mixture reduces baked strength and surface hardness of the core to such an extent that the core is too weak for most applications. Smaller percentages of clay are not as detrimental but affect the collapsibility adversely (Graphs 1 and 2).

3. Baking temperatures of over 450 F are very critical, as may be seen from Graph 1.

4. There seems to be little tendency to overbake at temperatures under 425 F (Graph 1).

5. An increase in corn flour content increases both the green strength and the baked tensile strength (Graph 5). However, corn flour contents in excess of 2 per cent by weight increase stickiness and decrease flowability, resulting in poor workability.

6. Additions of up to 2 per cent iron oxide and 5 per cent silica flour improve workability and slightly in-

crease the baked tensile strength. However, these additions produce a core having poor collapsibility.

7. The addition of ½ per cent wood flour tends to reduce the baked tensile strength slightly and the surface hardness to a greater extent. Other properties do not seem to be influenced except for an improvement in collapsibility.

8. The introduction of 20 per cent fine sand (No. 90 silica sand) tends to weaken the baked properties slightly. The working properties, however, are improved and there is not as much increase in baking time required as would be expected (Graphs 2 and 6).

9. It was found that pH (a measure of acidity or alkalinity) has a definite effect on both the green and baked properties of the mixture. As the pH increases, that is ,the mixture becomes more basic, the baked tensile strength increases. On the other hand, as the pH increases the stickiness of the mixture also increases. We have found that a mixture with a pH between 6 and 7 has the best working properties, good baked tensile strength, and high surface hardness (Graph 7).

Production in the foundry increased to the extent that the core ovens could not supply enough cores with the existing core baking cycle. The sand in the oil core mixtures was changed from a No. 60 to a No. 40 silica sand in an attempt to speed the baking time. This required spraying the cores with blacking to maintain good casting finish.

February 1, resin core mixture "B" was developed for muller "C," based on the knowledge obtained in the laboratory, in an attempt to increase core production (Table 4). Mixture "B" had good green properties and gave no trouble in the core room. A number of cores for the large transmission case casting were made,

TABLE 4—CORE MIXTURE "B"

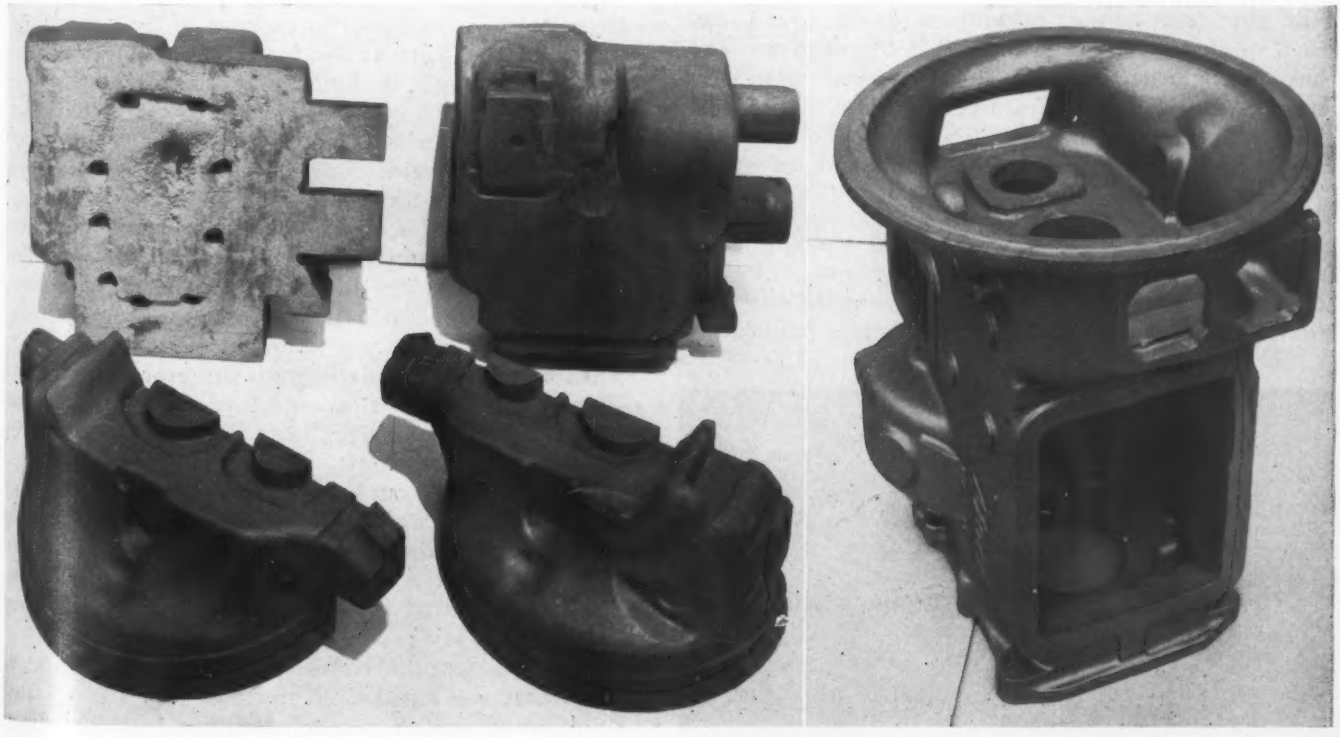
Silica Sand (dry) No. 40, lb	285
Iron Oxide, lb	3
Silica Flour, lb	12
Mixing Time, min	0.5
Resin "A", lb	1.5
Mixing Time, min	0.5
Water, per cent	to 4.0
Mixing Time, min	0.5
Corn Flour, lb	4.5
Mixing Time, min	5.0
Fuel Oil, cc	410.0
Mixing Time, sec	30
Discharge at once	

sprayed green with water and baked in the tower oven. The oven was on a 3-hour total cycle, which made 2 hours and 10 minutes from the time cores were put in the oven on the second floor until they were taken out on the first floor. The oil core for this casting required two trips around the oven on this cycle. The resin cores were taken off after one cycle, broken, and found to be completely baked and hard all the way through. The surface hardness was 100 or over and the baked tensile strength was 150 psi at 3.8 per cent moisture.

Castings produced with the resin cores had a better surface finish than castings made with oil sand cores, and the small amount of veining in castings made with oil bonded cores was completely eliminated.

The mixing procedure for mixture "B" required five separate additions to the muller and a total mulling time of 7 minutes. This procedure was modified for muller "C" as shown in Table 5. We found that this mixing procedure was much simpler, faster, and produced about the same properties as the first method.

We went into limited production on resin cores with



Core assembly for large transmission case casting. These resin cores have been sprayed green with 15° Baumé blacking solution. Note how drag body core (upper left) has been vented. Gas from this core is vented through hole in cope body core (upper right). Weight of core assembly, 197 lb. Right—casting made with core assembly shown at left. Note absence of veining of cored surfaces. Casting weight, 129 lb.

TABLE 5—MODIFIED CORE MIXTURE "B"

Silica Sand (dry) No 40, qt	100
Iron Oxide, qt	1
Silica Flour, qt	5½
Corn Flour, qt	8
Mixing Time, min	1
Resin "A", qt	1
Fuel Oil, pt	1
Water (4 to 4.5% moisture) qt	6
Mixing Time, min	4

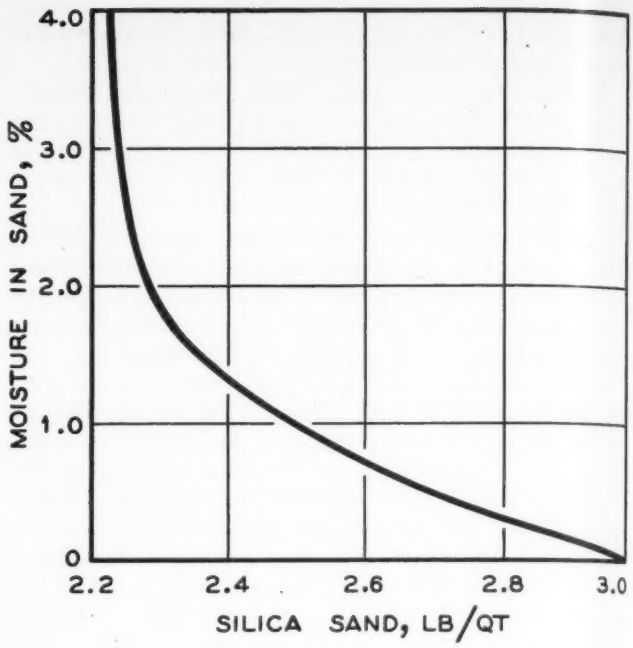
this mixture and have been in production since that time, except for a few interruptions. However, the resin core mixture has been changed several times as new problems presented themselves. Almost at once we found that some batches of resin sand were more sticky and produced harder and stronger cores than others. This condition resulted from the substitution of wet sand for dry sand, thus changing the ratio of the weight of resin to sand in the mixture. This is a common mistake in the foundry industry. Few people realize the vast difference in weight between unit volumes of wet and dry sand. From Graph 8 we set up charts for the number of quarts of sand to be used at different moisture contents to maintain a constant weight of sand.

In mixture "B," the iron oxide and silica flour additions reduced the permeability and heat transfer properties so that the core had poor collapsibility. An excessive time was required to remove the resin core from the casting and a few castings were scrapped for cracks. The iron oxide and silica flour were removed from the mixture and the resin cores then collapsed more readily than the oil sand cores.

At this time, there were indications that the production of resin cores would be increased in the shop and we realized the necessity of eventually using the "B," the "A," and the "C" mullers. It was found that each of these mullers developed different green and baked properties (Graph 9). In order to obtain constant green properties, a different mixture was set up for each muller, as shown in Table 6.

The resin core mixing operation was moved to the "B" muller and production spread to other medium

Resin core for housing casting being rammed on roll-over machine. Core on plate has been rolled over and is ready for spraying operation before baking.



Graph 8—Effect of moisture on weight of silica sand. Note the large change in weight of a quart of sand with moisture contents from zero to 2 per cent.

sized cores. The necessity for spraying resin cores with water made it obvious that substituting a thin blacking suspension would produce the same high surface hardness in the core and give a better casting finish. Since this was recognized we have sprayed all resin cores (where spraying is possible) with a 15° Baumé blacking suspension and the results have been satisfactory.

Around the middle of March, we were making a large transmission core from resin sand. This was the largest core we had tried; weighing 80 lb, it was 9 in. high and 10x15 in. at the plate. Upon checking the dimensions closely, we found that this core was sagging about $\frac{1}{16}$ in. and spreading about the same amount. We found that a mixture of 65 per cent sand of 40 A.F.S. Fineness and 35 per cent 90 fineness, giving a fineness of 60-65 for the mixture, eliminated the sagging encountered with 100 per cent 40 fineness sand.

There was some sacrifice in baking time, although it was possible with this change to bake resin cores completely in one half the time required for oil cores, and a better finish was obtained in the casting. It was found that the mixture was superior to a straight 60 fineness sand in elimination of sag and speed of baking. This mixture has been used in all resin cores produced since that time.

A number of tests were conducted in which the amount of No. 90 silica sand was varied from zero to 50 per cent of the sand in the mixture, and it was established that a minimum of 35 per cent No. 90 sand was required in the resin mixture to eliminate the tendency toward sagging.

Our production of resin cores suddenly became so great that the anticipated demand for No. 90 sand could not be met. We were forced to substitute a 2 per cent clay bank sand with a fineness of 111 (Table 1) for the No. 90 sand. With this mixture we were able to use less corn flour and obtain the same green strengths, and there was no measurable difference in

TABLE 6—CORE MIXTURE "C" FOR DIFFERENT TYPE MIXERS

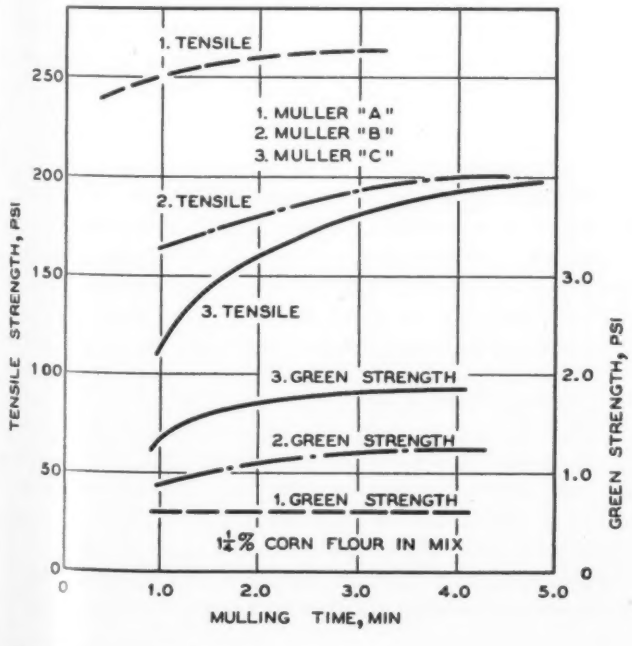
Material	Mullers		
	"A"	"B"	"C"
Silica Sand (dry) No. 40, qt	110	110	110
Corn Flour, qt*	10–12	9–11	8–10
Mixing Time, sec	30	30	30
Resin "A", qt	1	1	1
Fuel Oil, pt	1	1	1
Water, qt	5	5	5
Mixing Time, min	1	3	4

* Amount varies with size of core.

the working properties or the baked properties of the new mixture. However, we found that some castings were cracking and the cores were not collapsing as well as before, so this more economical mixture was discarded in favor of mixture "C" (Table 6).

The resin core mixture was made the standard mixture for such cores as the large transmission, oil pans, housings, large and small transmission cases, and similar cores. Production of resin core sand leveled off at about 40 tons of resin sand mixed per 24 hours. This completely eliminated the bottleneck on the tower ovens for the casting production rate at that time. Castings which we had been able to keep on the molding loops for only 18 to 24 hours could be scheduled for production for 3 or 4 days. Thus the time lost for pattern and flask changes was drastically reduced, and this resulted in a greater over-all casting production in the shop. Our three batch-type core ovens used for baking larger cores then became the bottleneck, and we attempted to make these cores from resin sand. Our initial efforts were successful and we were ready to go into production with the resin mixture. On our first production run we found that it was impractical to bake resin cores in this type oven due to a critical

Graph 9—Mixing effect on physical properties of resin mix. Mixer "A" gives highest tensile and lowest green strengths. Green strength in all cases may be increased by increasing cereal addition (Graph 5).



Tractor radiator top core made on core blower. Lower half of box has been lowered and machine has moved horizontally to right to receive core sand from hopper above. Mechanical roll-over is shown in background.

overbaking tendency. Having no recirculating device, the ovens had higher temperatures in some parts than in others. With a temperature sufficient to completely bake cores on the bottom of the oven near the door, there was too high a temperature at the top of the oven. We are converting an old batch-type oven into a modern recirculating-type oven with uniform temperature control in which we hope to successfully bake large cores bonded with resin.

Our efforts were again directed back to the medium size cores which we could spray with blacking, and all the cores of this type were made in resin sand with three exceptions: very difficult stand-up cores which would sag; core assemblies which required topping a baked core with a green core and rebaking; and cores in which the thickness from the strike-off surface was ⅛ in. or less.

The core handling in our foundry requires cores with surface hardness in the range of 98 to 100 to keep core breakage, scarring, and chipping at a minimum. For this reason cores rolled into dryers are not made from resin core mixtures because they cannot be water sprayed in the green state.

By this time we had experienced several months of resin core production. Since we were baking resin cores in one half the time required for oil cores, we found that core baking capacity on the tower ovens had almost doubled. The longer molding runs for a given

TABLE 7—CASTINGS MADE WITH RESIN CORES

Casting Description	Weights, lb	
	Casting	Core
Truck Transmission Case	129	197
Small Transmission Case	84	125
Large Transmission Case	132	84
Tractor Oil Pan	200	114
Tractor Housing	128	122
Tractor Radiator Top	77	60
Tractor Oil Pan	138	104
Tractor Oil Pan	110	63
Tractor Roller	24	25

TABLE 8—COMPARATIVE COSTS *—RESIN AND OIL SAND CORES

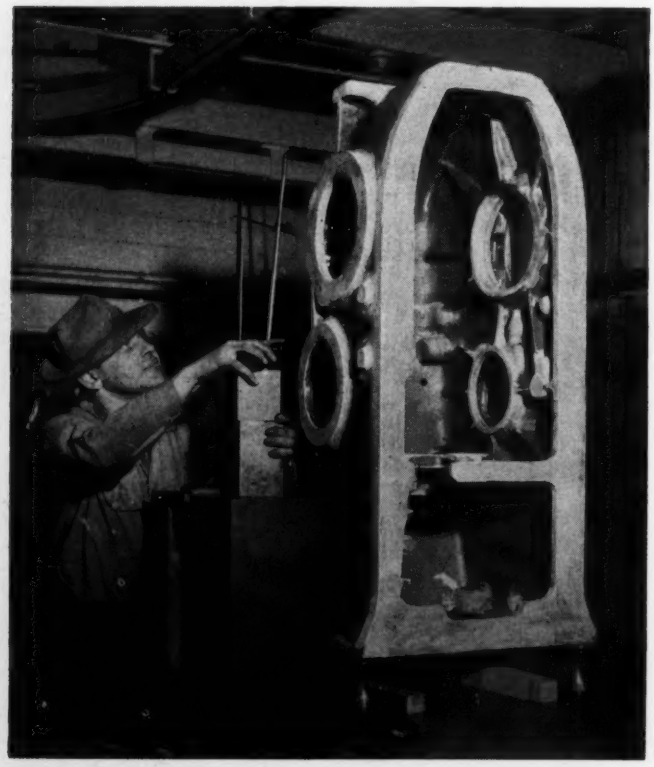
Material	Resin Mixture		Resin Blowing Mixture		Oil Sand Mixture		Oil Sand Blowing Mixture	
	%	Cost	%	Cost	%	Cost	%	Cost
Silica Sand	97.5	44.8	96.5	44.3	96.9	44.5	96.4	44.2
Western Bentonite	—	—	—	—	0.2	0.4	0.21	0.4
Corn Flour	1.5	17.4	0.6	7.0	0.99	11.5	0.99	11.5
Core Oil	—	—	—	—	1.91	43.6	2.40	54.8
Fuel Oil	0.26	1.7	0.25	1.6	—	—	—	—
Resin "A"	0.74	25.8	0.73	25.6	—	—	—	—
Combination Green—Dry Binder	—	—	1.92	33.6	—	—	—	—
Total Cost		89.7		112.1		100.0		110.9

* Costs shown are based on oil sand mixture as 100.

pattern, less cores required in storage, and less breakage due to better strengths and hardnesses of the cores led to an over-all increase in castings produced. The castings, on the average, required less cleaning and there was lower loss of castings due to defects attributed to cores. There was a marked decrease in the fumes coming from core ovens, pour-off, and shakeout.

The original idea in developing the resin core was to eliminate trouble encountered from core sand contamination of the chemically treated molding sand. Production of castings had increased, core-to-metal ratio had increased, and core collapsibility had increased—all detrimetal factors to the molding sand when using oil bonded cores—yet with resin cores the properties of the chemically treated sand were as good, if not actually better, than before. We found that when making castings with a high core-to-metal ratio the molding sand storage hoppers overflowed. To avoid discarding good molding sand an attempt was made to use overflow molding sand in the resin core mixture.

Checking dimensions of large casting. Cores for this casting have been made successfully from a resin mix. Casting weight, 650 lb. Core weight, 744 lb.



From previous experiments, we knew that collapsed oil core sand or collapsed resin core sand could be used up to 100 per cent in the resin mixture provided it was not contaminated with the bentonite of the molding sand. Further investigation showed that the overflow sand from the molding sand systems can be used up to 20 per cent of the resin mixture with only a slight reduction in baked strength and hardness. If this overflow sand were washed free of bentonite and clay it could be used in the resin mixture in any proportion.

By July, casting production had increased to such an extent that two new 72-in. cupolas were installed to replace the 60-in. furnaces. Our oven baking capacity again became the bottleneck. We were still using oil sand for the coreblower to produce cores baked in No. 1 tower oven and planned to install several core blowers for cores to be baked in the No. 2 tower oven. Up to this time, we had experienced very little success in blowing resin bonded cores . The problem became very critical since some of the oil sand cores we were blowing required three cycles in the tower oven and others required two cycles for complete baking. This took up much needed oven space.

Experiments were started in the laboratory to develop a core oil mixture, for blowing, which would bake with more speed than the regular oil sand blowing mixture. Various chemicals and binders were used with little success in shortening baking time. One material, a combination green and dry binder, improved the blowing properties of the mixture, so it was used with the liquid phenol-formaldehyde resin in an attempt to produce a resin blowing mixture.

Blow Resin Bonded Cores

A mixture containing 2 per cent by weight of the combination green and dry binder, ½ per cent by weight of cereal binder, and ½ per cent by weight of resin blew exceptionally well. In fact, the core blower operators reported that this mixture had better workability than any oil mixture they have used in the machines. The cores made from this mixture bake almost as fast as the regular resin cores, and some of the cores which required three cycles in the tower oven were baked completely in one cycle. All cores that were being baked in two cycles are baked in one with the new mixture. To date over 150 tons of this core mixture have been blown without any complaints as to sticking or other disadvantages.

Higher surface hardness, especially on the core plate surfaces, was obtained with this mixture than with

either the regular resin mixture or the regular oil sand mixtures, without the application of the water spray.

In our plant application, we have not been too concerned with trying to make small cores from the resin mixture because of the cost and impracticability of spraying. However, we do have a special application that justifies a resin mixture for small cores. This application requires an extremely hard surface and high baked tensile strength and spraying is impractical. The resin content of the mixture is one per cent and the combination green and dry binder content is 2 per cent, which makes a much more expensive mixture than oil sand. However, on a special casting, track rollers for track-type tractors, resin cores are used because the castings are made entirely in dry sand cores. If cast in oil sand the fumes make it inconvenient to produce more than a few castings in a single heat.

To date over 3500 tons of resin cores have been made in our core rooms in addition to the normal oil core production. The majority of these cores have been used to make castings requiring a pressure test. Most of the castings are oil reservoirs which must have a very smooth cored surface, absence of veining, and no burnt-in sand. Table 7 shows the types of castings made with resin cores. Casting losses from defects attributable to cores have been materially reduced.

Table 8 is based on the cost of our regular oil sand mixture as 100. On this basis the cost of our regular resin mixture is 89.7, the cost of our resin blowing mixture is 112.1, and the cost of our oil blowing mixture is 110.9. The storage life of the resin is questionable at temperatures over 70 F, so we keep the 550-lb drums in refrigerated storage and bring it to the plant one or two drums at a time, as needed, using the oldest resin first. We have experienced no trouble with the resin deteriorating due to aging or being in the plant.

Acknowledgment

The authors wish to acknowledge the valuable advice, laboratory data, and shop data on synthetic resins gained from G. Vennerholm, Chemical and Metallurgical Research Dept., Ford Motor Co., and to express appreciation for the contribution of Dr. A. C. Lansing, Reichhold Chemicals, Inc., for his work in the laboratory at Lynchburg Foundry Co., and for help gained from his knowledge of synthetic resins.

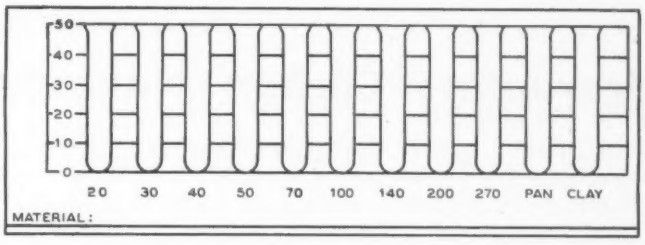
Britain's National Foundry College To Feature Pre-Diploma Curriculum

THE 1948-49 SESSION of the National Foundry College, which began September 27 at the Technical College, Wolverhampton, features this year, for the first time, a preliminary course of six months' duration, to be designated Part I of the College's regular diploma course. Although requirements for entrance into the College stipulate that candidates must have a minimum of one year's practical foundry experience, plus a university engineering degree or its equivalent, it has been found that some candidates have been insufficiently prepared for the College's stringent curriculum in the past, and the preliminary course was conceived to aid these students.

Students who take the preliminary course are required to follow it with six month's actual work in a foundry before going on to the regular diploma course.

Show Grain Distribution With Chart

PICTORIAL RATHER THAN NUMERICAL portrayal of sand grain distribution can be made conveniently by means of a stamp first used by Bradley H. Booth, foundry engineer, Carpenter Bros., Inc., Milwaukee. The stamp, reduced about one third and illustrated below, was devised as a result of reading the paper "Controlling Sand Grain Distribution Reduces Steel Foundry Costs" by Clyde A. Sanders, engineer, American Colloid Co., Chicago. This paper, which appears in the April issue of AMERICAN FOUNDRYMAN, pages 142-146, describes the savings in binders and the improved properties of



foundry sands with proper grain distribution. Desirable and undesirable grain distributions are illustrated by means of line drawings of test tubes containing varying amounts of sand retained on the screens used in determining grain distribution.

Foundrymen can obtain further information about the rubber stamp from Mr. Sanders or Mr. Booth.

WANTED! BOUND VOLUMES OF TRANSACTIONS OF A.F.S.

Arrangements to sell your bound volumes of TRANSACTIONS OF A.F.S., intact and in good condition, can be made through A.F.S. headquarters. The following volumes are especially needed:

VOLUME	YEAR	VOLUME	YEAR
1	1896	18	1909
2	1897	22	1913
3	1897	26	1917
4	1898	31	1923
5	1898	33	1925
6	1899	35	1927
7	1899	38	1930
8	1900	39	1931
9	1901	40	1932
10	1902	41	1933
11	1902	42	1934
12	1903	43	1935
13	1904	44	1936
14	1905	45	1937
15	1906	46	1938
16	1907	47	1939
17	1908	48	1940

Those who have no further use for the bound volumes of TRANSACTIONS OF A.F.S. listed above, or any other volumes of TRANSACTIONS on their bookshelves, are requested to communicate with The Secretary, American Foundrymen's Society, 222 W. Adams St., Chicago 6, Ill.

Preventing Carbon Monoxide Accumulation In Foundries

In Sweden, where the winters are quite severe, foundries are sealed against entry of cold air so effectively that carbon monoxide tends to accumulate in spite of ventilation provided. Swedish foundry workers receive regular medical examinations and blood tests to make sure they are not affected by carbon monoxide. Originating with the Swedish Ministry of Labor, an inquiry regarding the carbon monoxide problem in North America was answered by a round-up of opinions from foundrymen in the northern part of the United States and in Canada.

Furnaces Well Exhausted

The question of carbon monoxide in foundries is new to us but it should not be overlooked, particularly in a small shop such as we operate. We have two oil-fired crucible furnaces melting brass and aluminum in a two story building about 25 ft square. One furnace is on each floor. We depend on these furnaces as a source of heat in the winter and therefore on cold days the foundry is closed as tightly as possible. This is not as tight as we would like since it is often difficult to keep warm. Both furnaces are well exhausted, the lower by a fan, and the upper by natural ventilation. No one gets sick from carbon monoxide or from zinc fumes. Possibly the cracks which we would sometimes like to seal keep us alive.

The air we consume in the foundry must be replaced or suffocation or monoxide poisoning are definitely possible. The Swedish problem seems to require adequate ventilation.

A. C. Boak, *Foundry Superintendent*
Non-Ferrous Castings Co.
Toronto, Ont.

Suggests Free Air Circulation

To our knowledge carbon monoxide has never been a problem in Canadian or United States foundries. Some years ago we operated a small cupola which discharged gases into the foundry atmosphere but tests showed no carbon monoxide in the atmosphere. Ventilation was by means of louvres in the roof which evidently was sufficient. At present, we operate two gas-fired brass melting furnaces discharging into the atmosphere. Ventilation is by means of fans in the roof which is fairly low. We always have one large window open for air circulation. Tests by the local Workmen's Compensation Board show a change of air every six minutes. In our opinion there must be free circulation of air at all times.

Thomas Cowden, *General Manager*
William McPhail & Sons Ltd.
Vancouver, B.C.

Molds Air Cooled

Since our casting methods involve only permanent molds we do not face a condition such as exists in the Swedish foundry industry. All our molds are air-cooled and this, plus additional air brought in through a ventilation system of roof vents and windows, eliminates all traces of carbon monoxide. It would seem that the Swedish foundries should provide additional air either in the form of natural or forced draft to exhaust all gases at their source.

Howard H. Wilder, *Chief Metallurgist*
Foundry Division, Eaton Mfg. Co.
Vassar, Mich.

Encountered CO Three Times

We contacted H. Mabson of the Industrial Accident Prevention Association regarding carbon monoxide accumulation and he has encountered a serious problem on three occasions. In each case it was found that the foundry had been sealed like a fortress to keep out the cold and also the air, and had continued to operate high-powered exhaust systems. As a result of insufficient air coming into the building, the partial vacuum created drew carbon monoxide, formed as a product of combustion in the melting operation, right back down the cupola stack into the building.

In a foundry with this condition existing and with one or more cupolas all in operation it would be rather apparent, as a definite backdraft would exist, with the flame as well as the carbon monoxide coming back into the shop. If one or more cupolas were standing idle while one was in operation, the carbon monoxide could be exhausted from the cupola of its origin and could be brought back into the foundry through the stacks into the idle cupolas. In this way it could go practically undetected until serious injuries to workmen had been caused.

The Industrial Accident Prevention Association in-

sists on adequate replacement air in a foundry, summer and winter, and finds a slit all around the building about two feet above the molders' heads the best solution. The replacement air should be about 10 per cent greater than the amount exhausted.

J. DALBY, *Manager*
Wilson Brass & Aluminum Foundries
Toronto, Ont.

Keeps Air Circulating

It would seem that they have almost hermetically sealed foundries in Sweden. In our foundry and those we have visited we have never encountered the accumulation of carbon monoxide gas. We manage to keep the foundry warm during the winter in spite of the continual opening of doors to deliver melting stock and molding supplies, and the row of dormer windows in the roof. We keep a free circulation of air and at no time have experienced bad gases. Even during a heat we keep a good air condition during pouring-off by controlling our core oils.

R. T. RYCROFT, *President*
Kencroft Malleable Co., Inc.
Buffalo, N.Y.

Never Encountered Problem

In 30 years of foundry practice we have never run on to the problem of carbon monoxide gas. If it were our problem we would try to eliminate the carbon monoxide at the source, checking core ovens, heating and melting furnaces, and any possible sources to see that they were vented and had adequate draught. In a tightly sealed foundry the enclosed oxygen is probably being used. If this is the case, we would bring in outside air.

JASPER N. WHEELER, *Vice-President*
Wheeler Bros. Brass Founders, Inc.
Troy, N.Y.

Control Fumes at Source

We have never experienced any bad effects from carbon monoxide in our foundry. As a matter of fact, a few years ago we tested the gases in our plant and did not find a sufficient quantity of carbon monoxide to cause trouble. We melt steel with electric furnaces; in gray iron foundries melting with coke the problem of carbon monoxide might develop. In any event, we believe this is a matter of controlling the fumes at the source and installing proper ventilation.

S. V. WOOD, *President*
Minneapolis Electric Steel Castings Co.
Minneapolis, Minn.

Recommends Ventilating System

We do not know of any Canadian foundry taking any particular precautionary measures against carbon monoxide, perhaps because none of our buildings are sealed tight enough to make its presence a definite hazard. However, several of the newer foundries and some of the older ones have, or are installing, ventilating systems with the idea of getting rid of excess gases and smoke.

E. N. DELAHUNT, *General Supt.*
Warden King Limited
Montreal, Que.

Uses Exhaust Fans

Accumulation of carbon monoxide is not a problem in our plant because there are plenty of fresh air openings allowing a sufficient amount of fresh air to enter. In the wintertime we use enough exhaust fans to remove harmful gases.

R. T. WILSON, *Plant Superintendent*
Ontario Malleable Iron Co., Ltd.
Oshawa, Ont.

A.F.S. Hygiene Code Recommendations

"In any type of exhaust system some form of air flow producing equipment shall be required to create the pressure necessary to cause the air to flow through the system to the discharge stack.

"Natural draft shall not be depended upon to remove harmful or dangerous gases, fumes, mist, dust, or other matter when it is imperative that such matter be removed from the work place or room atmosphere. Natural draft or ventilation shall only be employed as an aid in the general atmosphere control and ventilation of a work room or place."— Section VIII (A), *Fundamentals of Design, Construction, Operation and Maintenance of Exhaust Systems.*

Section X (A) of the same A.F.S. code is: "When the amount of air exhausted from a workroom or building exceeds six times the cubical contents per hour of such workroom or building, clean, fresh air shall be admitted into the workroom or building by intake vents or positive mechanical fans to make up the difference between the amount exhausted and at least six times the cubical contents.

"Means shall be provided for heating the make-up air to maintain the proper temperatures within the workroom or building. These provisions may be ignored in warm weather if windows and doors are kept open which will permit the make-up air to enter such openings."

According to Section XX (B) of *Recommended Good Safety Practices for the Protection of Workers in Foundries*, one of the six A.F.S. safety and hygiene codes: "Salamanders and other unvented heating devices shall not be used inside of buildings for the purpose of supplying heat to the buildings."

Revamp Midwest Engineering Journal

THE WESTERN SOCIETY OF ENGINEERS announces that its technical *Journal* and semi-popular *Bulletin* have been combined into a single magazine, the *Midwest Engineer,* with broader editorial and news coverage.

Technical articles of interest to engineers will continue to be published but the editorial content will also include stories of general interest to the public. *Midwest Engineer* will be published monthly except June, July, and August, starting with September, 1948.

REDUCES ANNEALING CYCLE

Malleable Foundry Develops Insulation Method

Utley W. Smith
Manager
Magnesia Insulation Manufacturers Assn.
New York

EFFICIENCY OF FURNACE OPERATION, as reflected in fuel consumption, firing time and total annealing cycle, is directly related to furnace insulation. This fact was strikingly illustrated in one foundry when it changed to a new insulating technic. An old malleable iron annealing furnace, of heavy firebrick construction backed by calcined diatomaceous silica brick, was rebuilt with light insulating refractory brick, backed by courses of diatomaceous silica and 85 per cent magnesia insulating blocks. This change doubled the capacity of the furnace by reducing the annealing cycle from 120 hr to as low as 72 hr, and reducing the firing time from 80-100 hr to about 40 hr.

The change in construction which utilized the lightweight, low heat capacity insulating refractory brick instead of the heavy, and consequently high heat capacity firebrick lining is basically responsible for this outstanding improvement in operational characteristics. To reduce heat transfer to a minimum and allow the most economical construction, the insulating refractory brick of the walls was backed up by insulating block materials with a lower temperature limit but lower thermal conductivity.

The insulating refractory brick is of a fire-clay base made porous by the addition of sawdust in the molding. This, of course, burns out during the firing, resulting in a porous, lightweight, efficient brick.

Diatomaceous silica is composed of fossilized microscopic plants, called diatoms, and is made in several forms for insulating purposes. Combined with asbestos fiber, the product is molded into blocks and other shapes and is used in a temperature range of about 600 to 1900 F, frequently in combination with 85 per cent magnesia. The latter is a molded product consisting of 85 per cent magnesium carbonate and asbestos fiber which serves as a binding ingredient. It has a very low heat conductivity and is an excellent insulator for temperatures to about 600 F.

The foundry under discussion had been operating two batteries of direct-fired annealing furnaces, each battery consisting of six furnaces. Maximum operating temperature was 1950 F. The walls and arch of the furnace were constructed of firebrick, 13½ in. thick, the walls being backed by a 4½-in. thickness of calcined diatomaceous silica insulating brick. The floor was constructed of paving brick and concrete.

When one of the furnaces required rebuilding, the works engineer of the foundry thought it desirable to avoid the heavy firebrick because of its high heat capacity. Instead, the new walls and roof were built of 2300 F and 2600 F type insulating refractory brick, respectively, except for the section of the roof directly in front of the powdered coal burner. This portion of the roof would be subjected to abrasion and slag action from the powdered coal, and it was therefore constructed of firebrick.

The wall of insulating refractory brick was laid in a 13½-in. thickness. In every fifth course, vertically, a

Insulating refractory brick wall over a backing of diatomaceous silica and 85 per cent magnesia blocks. "T" bars welded to the steel shell secured refractory wall.

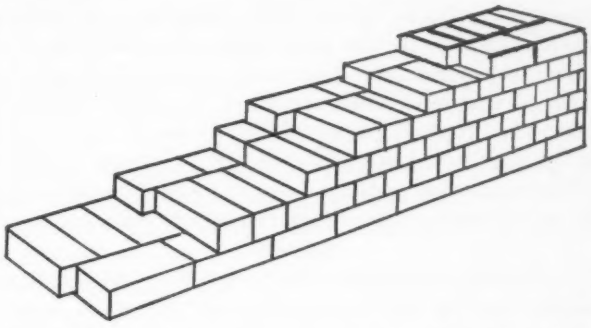
View of annealing furnace with materials used in insulating furnace walls: 85 per cent magnesia blocks, diatomaceous silica blocks, and light insulating bricks.

header row of brick was used with a stretcher course to tie the wall into a solid unit. As the brick was laid, it was backed by a 2-in. layer of diatomaceous silica blocks. Backing the diatomaceous silica insulation, between it and the steel casing, was a 1-in. layer of 85 per cent magnesia blocks.

To secure the inner wall to the steel shell two rows of "T" bars were used with the "T" imbedded into the brick and the leg welded to the shell. The "T's" were on 24-in. centers and the rows spaced 24 in. apart. The upper row was approximately 12 in. below the bottom of the skewback.

The insulating refractory brick in the arch was 9 in. thick and of the 2600 F type. Where firebrick was used in the arch, it was backed by a 2½-in. layer of diatomaceous silica block. The floor, requiring materials of high load-bearing characteristics, was constructed of a combination of 4 in. insulating concrete, 10 in. of calcined diatomaceous silica brick, and 4 in. of paving brick for the wearing surface.

The lowered heat capacity of the lining and the reduced heat transfer through the furnace walls naturally resulted in improved temperature distribution in the furnace. In order to provide more accurate temperature control, thermocouples were installed at several locations and connected with recording instruments to operate the dampers on the flues and control the firing equipment. Better control of operating temperatures in the new furnace has resulted in a more uniform product and practically eliminated rejections due to the scaling of castings caused by prolonged exposures to elevated temperatures.



Sketch showing wall constructed mainly of header courses. This type possesses many of the advantages of the all-header construction, but some sacrifice is made to obtain greater rigidity by laying a minimum number of stretcher courses, one stretcher to three or four header courses.

Walls of annealing furnace under construction. After the 85 per cent magnesia blocks were placed against the steel casing, a layer of diatomaceous silica blocks was laid, and then the insulating refractory brick wall.

ANNEALING FURNACE INSULATION

Old Furnace	Rebuilt Furnace
Wall	
1. Firebrick, 13½ in. 2. Calcined diatomaceous silica brick, 4½ in.	1. Insulating refractory, 13½ in. 2. Diatomaceous silica block, 2 in. 3. Magnesia block (85 per cent), 1 in.
Arch	
1. Firebrick, 13½ in.	1. Insulating refractory brick, 9 in. Portion near burner: 1. Firebrick, 9 in. 2. Diatomaceous silica block, 2½ in.
Floor	
1. Paving brick, 5 in. 2. Concrete, 18 in.	1. Paving brick, 4 in. 2. Calcined diatomaceous silica block, 10 in. 3. Diatomaceous silica insulating concrete, 4 in.

In view of the highly satisfactory results obtained with the new furnace insulation, it was decided to rebuild an entire battery of furnaces. These were rebuilt in the same way as the first, with only slight modifications. Not only has fuel consumption been cut down by this method of insulation, but one battery of six furnaces now does the work formerly put out by 12 furnaces, and the second battery has been closed down.

Ardal, Norway's Greatest Aluminum Plant, Now Producing 35 Tons Daily

NORWAY'S NEWEST AND LARGEST aluminum plant, the Ardal Aluminum Works, State owned and operated, is now in production. Situated in a narrow valley overlooking the 140-mile long Sogne Fjord on the west coast of Norway, Ardal gets its electric power from the waters of nearby mountain lake Tyin.

Now working at half capacity, the Ardal Works includes two huge "electrolysis halls," one completed and the other half-finished. The halls are each 1200 ft long, 126 ft wide and 90 ft high and enclose 172 electric reduction furnaces, whose full capacity is estimated at 25,000 tons of aluminum per year. At present, the output is about 35 tons per day.

In 1910, Norsk Hydro, State-owned power agency, began construction of a 15-mile tunnel to bring the waters of Lake Tyin to Ardal. The tunnel was almost completed when Norway was invaded in 1940.

The Germans used forced labor to work on the tunnel and hydroelectric station and began construction of the aluminum plant. When Germany collapsed in 1945, the project was about half completed. Norwegian authorities finished the project this spring.

MAINTENANCE OF SAND LABORATORY EQUIPMENT

Care and maintenance of sand laboratory equipment is essential to consistent results. In connection with an extensive study made by the Green Sand Properties Committee, visits to the 13 cooperating laboratories resulted in the recommendations reported.

THE COST OF MOLDING with sand of poor physical properties is high. Every effort must be put forth to provide sand with the most desirable properties.

One important step is to measure the physical properties of the sand with testing equipment which has been: (1) Properly installed, (2) properly maintained, (3) properly calibrated, and (4) properly manned. The following outline will aid in keeping sand testing equipment in good operating condition.

Balance

1. Provide laboratory with two balances. Use one balance for the more accurate weighing, such as moisture determinations and grain fineness. The other balance is to be used for the coarser weighing such as sand samples for permeability and strength tests.
2. Wipe agate bearings with cloth to remove dirt.
3. When balance is equipped with center agate bearing cover with side thrust plates, renew cover when side thrust plates show wear.
4. A balance for accurate sand test weighing should have not less than 20 mg sensitivity at 200 gram load.
5. Always weigh with scale in motion, not at rest.

Weights

1. Two sets of weights should be available. One for the finer weighing and the other for coarse weighing.
2. Weights wear and lose their original accuracy, and therefore should be handled with care.
3. One set of weights should be available that will show not more than 20 mg error when any combination of weight is used to total 200 grams.

Moisture Teller

1. Lubricate bearings and pan holder bearing point.
2. Rapid drying requires high air volume. Keep motor in good repair to maintain full speed.
3. Maintain air heater tube in vertical position.
4. Keep air funnel tightened to air tube.
5. Sample pan must contact bottom of air funnel throughout circumference.
6. The compression ring must press filter cloth down tightly against bottom flange of the sample pans. Tighten compression rings by placing pan against a solid metal corner. Use a square edged tool such as a punch. Hold tool at a 45° angle and drive punch with a hammer so as to dent top of compression ring into vertical wall of pan. Do this every 2 in. On newer style pans this is not necessary.
7. Occasionally blow air with the mouth on bottom of filter cloth to remove dirt from filter cloth.
8. Every three months check the weight of each pan. Place a fifty gram weight in pan and weigh against tare weight. Place a piece of emery cloth on top of bench. Place either the tare weight or pan, whichever is the heavier, on the emery cloth and remove sufficient metal to cause equal swing of balance.

Sand Rammer

1. Lubricate rammer moving parts with SAE 10 oil. Check the height of weight drop. Weld tip of cam if necessary to give 2 in. drop, tolerance ± 0.005 in. Keep cam bearing and cross head of rammer in good repair.
2. Bolt rammer firmly to solid wood, concrete or timber pillar.
3. Before testing, riddle sand through a ¼ in. mesh screen and place in covered container. Uncover container only when taking sample.
4. Weigh out each sample of sand to cause rammed specimen to come within $\frac{1}{32}$ in. of 2 in. length.
5. Use the same specimen tube. Mark one end of specimen tube and ram specimen in the marked end. Smoothness of specimen tube bore greatly affects test readings. Use a master tube to check regular tube.
6. Before ramming turn specimen tube ¼ turn with plunger resting on loose sand in specimen tube.
7. Take great care in turning crank of rammer the same each time. Make three separate turns of the cam, stopping at 4 o'clock position each time. Complete turn of crank fairly rapidly each time.
8. Before specimen tube is inserted in rammer, wipe plunger head and base free of loose sand.

Permeability Meter

1. Permeability meter must be level .
2. Drum must not rub on tank.
3. Tip of permeability dial must be level with water in manometer tube.
4. To test for leaks close end of specimen tube with stopper, remove orifice, and set tube in mercury. Manometer should read 10 cm and drum should not settle noticeably in 30 seconds, when system is under pressure.
5. Use a wet cloth to clean mercury of oxides, dust, and sand.
6. Check time of orifices when control testing.
7. For precise testing use A.F.S. stopwatch method.

Sand Strength Machine

1. Level strength machine unit.
2. Weight should swing freely.
3. Test holes in pusher arm and weight must be in line. Insert $\frac{9}{16}$ in. rod through holes to check.
4. Use swivel compression heads.
5. Rack and pinion gear should be dry and free of grit. Clean with steel brush.
6. Insert 2 in. specimen and adjust length of switch reversing rod so that it clears the weight by $\frac{3}{16}$ in. Disconnect electric current during this adjustment.
7. When using hand operated machine, practice turning hand wheel so that 7.5 psi compression reading is obtained in 15 seconds.
8. Use a 1 in. wide brush to clean strength machine after each test. Brush sand off gear quadrant between pusher arm and weight. Wipe compression heads free of loose sand.
9. Wipe top of stripping post free of loose sand.

Deformation Accessory

1. Adjust the leaf spring bearing against the rack gear so that a friction load of ¼ lb is obtained as one swings it back and forth by hand.
2. Keep fulcrum bearing well lubricated and free.
3. The friction of the maximum reading hand of the indicator must not be too great. A load of 2 oz should move this hand. In case this hand offers perceptible friction remove bezel and adjust spring load.

REDUCING CASTING COSTS VIA THE PATTERN SHOP

E. J. McAfee
Master Patternmaker
Puget Sound Naval Shipyard
Bremerton, Wash.

CONSIDERABLE THOUGHT HAS BEEN GIVEN to the cost of patterns, their construction and the relative effect upon the cost of the finished casting. Many purchasers of castings do not understand why the cost of the patterns should be added to the price of castings as they are no part of the finished product. For the same reason some manufacturers consider the pattern shop a necessary evil, and have done nothing about making it an efficient adjunct of the plant. With proper engineering, the pattern department can assist materially in reducing casting costs.

Many things can be done toward reducing pattern costs and enhancing quality and production.

1. First to be considered is the plant or shop, and its physical equipment, in which the patterns are to be constructed. The shop may be part of a manufacturing plant, or a private plant, usually designated as a jobbing shop. The shop should be properly heated and ventilated, and good lighting provided, with a maximum of daylight. There are some well-equipped pattern shops in the West, but they are in the minority, especially in the Northwest section of the country.

Good, low-cost patterns cannot be produced in dingy, poorly ventilated, hole-in-the-wall shops any more than sound castings can be made in poorly equipped hodgepodge foundries, of which the author has seen many.

2. A well-equipped pattern shop does not necessarily require a large amount of space. The size of the shop should be governed by the maximum anticipated volume of work. Equipment should be of standard makes and good quality, suitable for the type of work to be accomplished. Each type of pattern—plaster, wood, metal or plastic—requires some special equipment for its economical manufacture. In all cases the plant must be equipped with an efficient dust collector system, not only to provide a clean space for the artisan to work, but also to reduce the hazards which would be created by excess wood dust, chips, and waste material. The debris is ankle deep in some shops.

3. Pattern lumber of the various types, such as pine, mahogany, and others suitable for patterns, should be stocked in sufficient amounts to ensure time for proper air drying to the relative humidity of the storage area, or have available kiln-dried material. If kiln-dried lumber has a low moisture content it will quickly absorb moisture equal to that of its storage space.

Many a pattern has been ruined by excessive lumber shrinkage due to improper seasoning, with the resultant additional cost of repair or renewal. The use of good pattern stock is an economy in patterns of a standard nature which are to be retained for future use.

4. Supervision personnel for the pattern shop should be chosen with great care. Before appointing a supervisor, his background should be carefully scrutinized to insure that he is properly qualified, has sufficient knowledge of the type of patterns to be manufactured, and is thoroughly familiar with foundry methods and procedures. Through his knowledge of pattern construction and foundry practices, a competent supervisor will save the pattern shop many times his salary.

5. Shop Organization: It is a common opinion that the pattern industry has avoided specialization. As in the past, a certain amount of resistance toward specialization still is encountered, but some progress has been made to that end. The pattern shop at the Puget Sound Naval Shipyard is an example of good organization. Just prior to World War II it had a small number of employees who were organized into coordinated specialized groups. From this nucleus the present organization was formed.

Planning Section: This is a well formed and efficient department which includes planners, layout, and inspection personnel with a supervisor in charge. The size of this group is regulated by the volume and type of work. Employees so assigned receive extra compensation over that paid to the highly skilled mechanics,

A section of the wood pattern shop. Good lighting and an adequate dust collector system have been provided.
(Photos courtesy of U. S. Navy)

Plastic and plaster patterns are produced in this section. Where rough handling is not involved, plastic patterns are preferred for quantity machine molding.

and are recruited from the mechanic group. This section is the heart of the organization. It is in constant contact with foundry and machine shop supervision, with which it works harmoniously to determine how certain jobs are to be molded and make recommendations for design changes to insure better castings. Foundry equipment available for the job is considered, and the group is kept informed of foundry practices which are constantly being improved through experience and study. The planning group is ever-alert to the problems of the foundry and machine shop.

Importance of Proper Layout

Layout Section: The layout group makes pattern-size working layouts of all patterns of importance, or where there may exist any question of judgment on the part of the patternmaker. This procedure eliminates the task of keeping each and every patternmaker at the bench informed of all the details of current foundry practices, thereby saving much valuable supervision time, reduces the cost of layout and positively makes for more accuracy, as these layout men have the proper tools and equipment available, plus more experience.

Checking: Upon completion, a pattern is checked by either the layout man or plannerman for accuracy and adherence to the layout, before assigning a file and identification number to it and writing casting orders to the foundry for the quantity and material desired.

Although this system of concentration, specializing the pattern layouts to this group, does not meet with the wholehearted approval of the mechanic, due to past custom when each mechanic laid out his own work, nevertheless it results in more uniform and accurate patterns and is a great factor in reducing pattern cost.

6. Pattern Loft: The storage area, approximately 24,000 sq ft, is the responsibility of a loftsman, with one assistant. Their duties are to properly catalogue and assign storage shelf space for each new pattern. These are cross-filed, both as to the nature of the pattern and its file number. Any pattern in storage can be readily produced within a few minutes upon request by the planning section when needed for casting production.

The stowage space is constantly occupied to full capacity. Space for new patterns is provided by the daily removal and destruction of obsolete and unwanted patterns by means of an efficient system of selection.

7. What type of pattern is to be constructed? It is the duty of the pattern shop superintendent to decide the proper balance between the quality and type of pattern and the quantity of castings desired in order to obtain the most economical end results.

Plastic Patterns: For machine molding and quantity production of castings where rough handling is not necessary, plastic patterns are superior.

Metal Patterns: Next in order of preference for quantity production, where rough handling may be encountered in hand molding or ramming, are the metal patterns.

Mahogany or Other Similar Hardwoods: Patterns made of these materials are most economical where a limited number of castings (up to 200) are required and accuracy is important.

Pine, Redwood, or Other Soft Woods: These materials should be used when a very limited quantity of castings is needed.

Plaster: This material is unexcelled where large patterns of a temporary nature are required, when they can be made with sweeps and extreme accuracy is not important, as in cornice work. It is also indispensable in the production of placque patterns of an artistic nature.

8. Few mechanics are well versed in all of the foregoing phases of pattern making, and the same holds true at this shop. As it is necessary that all of the listed types of patterns be manufactured in this shop, the facilities and necessary equipment have been provided. Those mechanics with exceptional skills in each type of pattern construction are practically specialists, and have expanded their skills and knowledge through application and on-the-job training conducted during the war period.

In order to augment this training program, a training manual suitable to the shop needs was compiled and produced. This was necessary as none was available

The planning, layout and inspection section of the pattern department is in constant touch with the foundry and machine shop. Here molding methods are decided and design changes recommended. All photographs in this article were furnished by the U. S. Navy Dept.

In this section of the pattern department metal patterns utilized in quantity casting production are made.

at that time. This manual received such hearty approval from the trade that the Pattern Makers League of North America, with the consent of the authors, adopted it as their official training booklet.

9. It was found through experience that a patternmaker with basic training in the art of manufacturing wood patterns can easily be trained as a specialist in any one of the other branches of the trade. This training makes it possible to have the shop organized into groups, each specializing in the manufacture of one or more of the various types of patterns, such as wood and metal, wood and plaster, plaster and plastics, etc. Specializing in this manner makes it possible to manufacture the type of pattern best suited to the job and the needs of the foundry, thereby allowing production of high grade castings at the lowest possible cost.

Casting vs. Pattern Cost

10. Low pattern costs are not as a rule synonymous with low cost castings. A demand for a low cost pattern usually will result in a cheap and poorly constructed job which will require extra foundry labor due to lack of draft, poor construction, and improper design. A three-part flask is often required where a two-part flask would have sufficed if the pattern had been properly engineered, even though the cost of the pattern would be increased by so doing.

A purchaser of castings who furnishes his own patterns often is reluctant to provide patterns that will decrease the foundry costs, especially if it increases pattern costs and the savings are not passed on to the customer. Many foundries charge flat rates per pound on various types of castings, figuring that economically produced castings of high tonnage will offset low profits on intricate lightweight castings with much core work. Usually, undue emphasis is placed upon the pattern cost, rather than the ultimate casting cost, when prospective castings sales are being discussed. Most customers do not object to the higher cost of productive patterns if the resultant savings in producing the castings are reflected in the price paid for them.

11. Foundries which are not equipped with pattern making facilities, and either sublet the pattern work or procure it through competitive bids, are somewhat handicapped in purchasing the type of pattern best suited to their needs. Unless strict pattern specifications are provided by some competent person, who understands patternmaking and is well informed in foundry practices, a purchaser of patterns may pay a low price for a poorly constructed and designed pattern, with a resulting increase in the cost of the castings.

12. Throughout the industry today there is a noticeable lack of liaison between design engineering and the actual producer of machines and materials. In many cases, weldments have been specified where properly designed castings could have been used to better advantage. This is due largely to design trends and because many designers are not well informed as to the value of castings as engineering materials.

Machine Developed for Conversion Of Liquid to Semi-Finished Steel

A PROCESS FOR THE CONVERSION OF STEEL from liquid phase to semi-finished shape by use of a simple, relatively inexpensive machine, has been developed through the joint efforts of the Republic Steel Corp. and the Babcock & Wilcox Tube Co.

The unit is located at the top of a 75-foot steel tower at Babcock & Wilcox's Beaver Falls, Pa., Plant. Steel is delivered to the unit from the company's regular electric furnaces and is poured into an inductively-heated holding and pouring ladle. By watching the liquid steel in the mold by mirror arrangement, the operators can see at all times whether the surface is clean and the process is functioning properly.

Shortly after the shell of the billet has been formed, the steel contracts and in so doing the billet shrinks away from the mold. The metal is thus in contact with the surface of the mold for only a few inches, and only in this short distance can it lose heat to the mold by direct contact.

Proper cooling of the mold is essential and its importance increases as the casting rate is raised. The more rapid the casting rate, the greater the quantity of heat which must be absorbed by the surface of the mold. It was found that a number of metals performed almost equally well as mold materials—$\frac{1}{16}$ in. steel, $\frac{1}{4}$ in. copper and $\frac{3}{16}$ in. brass. Brass has been found to have definite structural and fabricational advantages.

Since continuous casting requires a slag-free steel, the steel is poured from a holding furnace into a tundish, designed to strain out the slag. Thence the steel flows into the mold, below which the casting passes through an insulating chamber which arrests and controls the speed of further cooling. Below this chamber is the withdrawal mechanism regulating the speed of movement of the steel billet. The casting then passes an oxyacetylene torch which travels down the billet a short distance while the billet is being cut to specified lengths up to 35 ft. The cut-off section of the billet is lowered to a horizontal position by a cradle.

Developed after several years of continuous experiments, the first continuously cast steel for conversion into commercial products was made at Beaver Falls. Forty-five tons of 0.15C steel were shipped to a commercial user. The Beaver Falls unit at present casts two or three times per week. A section of about 30 sq. in. has been produced at a rate of 400 lb per minute, and has proved satisfactory for commercial use.

MAINTAINING CARBON-SILICON RANGES IN CUPOLA MELTING

RAW MATERIALS FOR THE FOUNDRY have not improved in supply during the past year. Scarcities still exist, and available materials are irregular in analysis from lot to lot. Thus, close control in cupola operation is imperative. Equipment must be in good condition and of adequate capacity. A full understanding of every phase of cupola operation is needed if the metal produced is to meet specifications.

It is possible that a foundry may operate good equipment under adequate control and still obtain irregular end results. This may be a case in which the desired carbon pickup is not obtained.

As an example of irregular results, the case of a foundry which had converted from furnace parts production to the manufacture of clutch plates, brake drums, marine engine parts, gear blanks and similar components will be considered.

When observations were first made in this foundry the metal poured contained from 3.13 to 3.59 per cent total carbon and 1.88 to 2.73 per cent silicon. The results were plotted on frequency curves (the lower curves of Figs. 1 and 2). Upon initial examination no great significance could be attached to these curves. However, when it was found that the desired ranges were 3.45 to 3.55 per cent carbon and 2.05 to 2.15 per cent silicon the curves assume considerable importance. They indicate quite clearly that the probability of falling within these ranges is small, since the curves do not have a normal probability shape. Stated another way, the number of times that the analysis came within the desired range was small compared to the incidence outside the range.

The problem was the determination of a method to correct this condition. The first step was to reduce the silicon content of the iron. In many cases, foundries are running irons with entirely too much silicon. Inasmuch as carbon pickup decreases with increasing silicon content, the obvious method of increasing carbon pickup is to decrease the amount of silicon in the charges. If a greater silicon content is desired in the finished castings, it can be obtained by ladle additions.

Calculation of the total carbon expected in the iron at the cupola spout was the second step. Here the work of W. W. Levi [1] was applied. The total carbon of the charge was calculated to be 3:10 per cent, and 0.40 per cent of carbon was picked up in the cupola. The carbon pickup was accomplished with proper control of several items which will be described later.

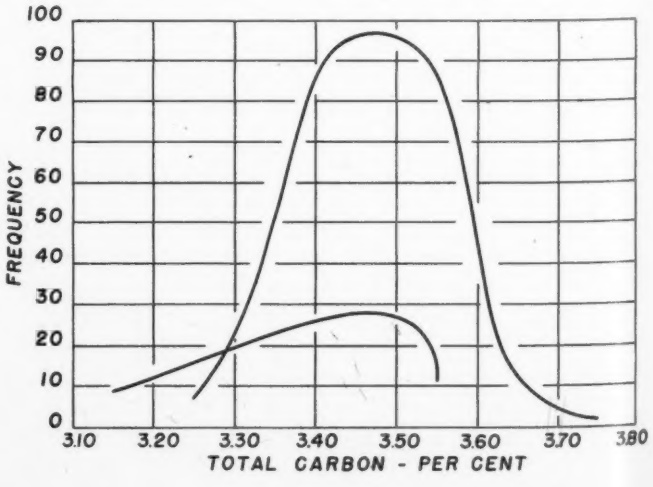
Figure 3 shows diagrammatically the cupola cross section. The No. 9½ cupola was operated with continuous tapping and back slagging. It will be noted from the diagram that the cupola was boshed, which was done for two reasons. First, it was desired to decrease the velocity of the gases in the upper part of the cupola stack. This, it is believed, helps to decrease the sensible heat loss, thus heating the melting stock to a higher temperature. Second, the boshing follows the natural burnout tendency of the cupola. This presumably brings the cupola to equilibrium more rapidly. After the first heat the corners in the boshed section are burned off. Following this, the natural course of erosion takes place.

The usual cupola practice in this foundry is to run a 3-hr heat in the afternoon. With this type of operation the average cupola lining life on a tonnage basis is as follows: well lining, 1300 tons; melting zone lining, 2800 tons; upper part of cupola, 5500 tons. In order to prevent the slag from covering the tuyeres the well was made larger by adding 4 in. to the diameter. This allowed the slag to drop directly into the well without coming into contact with the lower edge of the tuyere. The iron was tapped into a cylindrical mixing ladle. At no time was the ladle less than half full.

Slagging in this operation was carefully watched. The limestone charging schedule is shown in Table 1. The larger amount of limestone used at the beginning of the heat aids in forming the first slag and helps

This paper is the fourth of a series, dealing with modern cupola operation, sponsored by the Cupola Research Committee of A.F.S. Other papers will appear in future issues of American Foundryman.

Fig. 1—Frequency—total carbon (lower curve) and the plotted results of metal analyses (upper curve).



1. W. W. Levi, "Controlling Carbon in the Cupola," AMERICAN FOUNDRYMAN, Oct. 1947, pp. 28-34.

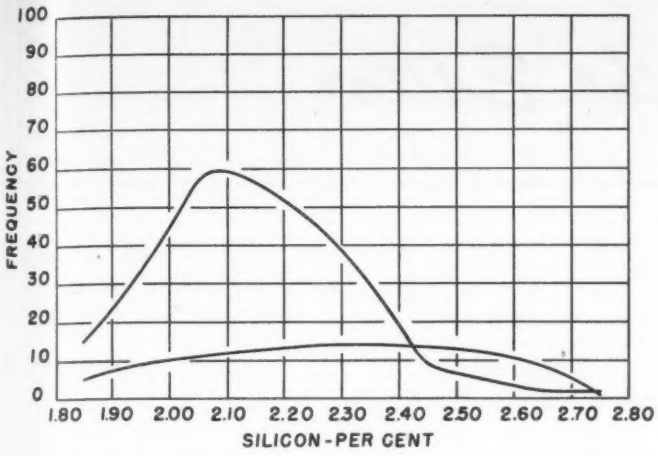


Fig. 2—Frequency—silicon content (lower curve).

bring the operation to equilibrium more rapidly. An olive-green slag is obtained. To check the color a piece of pipe was held under the slag spout and the slag allowed to fall on it. After the pipe becomes warm the slag adheres to it. The slag is air cooled to below a glowing temperature and then water quenched.

If the slag is dark in color, the cupola air volume is checked to determine if it is in excess. Next, the scrap in the charge is examined for excessive oxides. If the latter is not the case, the air volume is reduced immediately. On the other hand, if much rust is found on the scrap, limestone and siliceous material are added for the dilution of the oxides.

A cone-type charging bucket was used, and all ingredients were put into the bucket for each charge. A typical charging schedule is shown in Table 2. It was noticed that after the bucket had been discharged the coke and metal were thoroughly mixed in the stack. When viewed through the charging door, the coke seemed to disappear below the metal.

In this operation the bed height was 70 in., and metal to coke ratio 6.67:1. Total weight of coke per charge was 300 lb. Boosters were added on the 5th, 10th and 15th charges to maintain the bed height as the melting zone diameter increased. The additional coke was added in three charges in order to avoid making weight adjustments for each coke charge. It would have been much better practice if 60-lb coke additions had been made to each of the first 15 charges.

The foundry in which the foregoing observations were made felt that it was much more desirable to produce a slightly smaller quantity of good quality iron than a larger amount of erratic quality. After all of the changes mentioned had been made a melting rate of 14 tons per hour was established.

However, the operational changes made represent a considerable improvement in cupola practice. The resulting metal analyses were considered as before and

TABLE 1—LIMESTONE CHARGING SCHEDULE

Charge No.	Weight of limestone added, lb.
1-6	140
7-10	120
11 to end of heat	60*

* This quantity is adjusted for changing slag conditions.

TABLE 2—TYPICAL CHARGING SCHEDULE

Material	Material per Charge, per cent	Material per Charge, lb.
Pig Iron	30.0	600
Return and Foreign Scrap	52.5	1050
Steel	15.0	300
Silvery Pig Iron	2.5	50
Total		2000

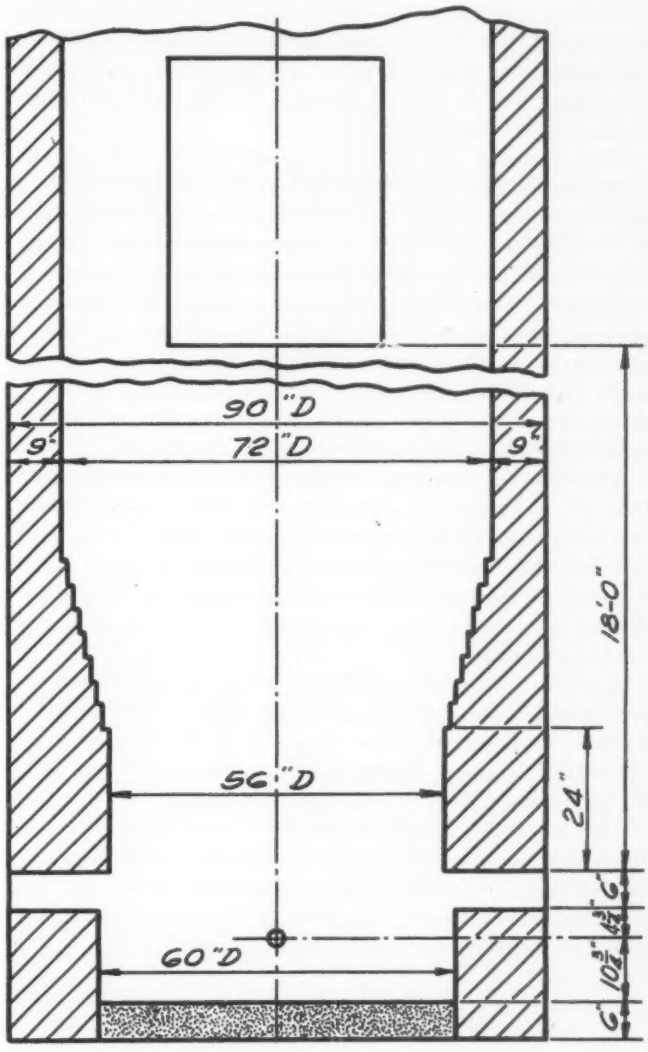


Fig. 3—Diagrammatic sketch of cupola cross section.

plotted as the upper curves of Figs. 1 and 2. It will be noted that the curves more nearly approach the probability curve shape. It appears, then, that the foundry had tremendously increased its chances of producing an iron of the desired analysis.

With data derived from the analysis sheets, the simple curves plotted as shown in Figs. 1 and 2 will give the foundryman an idea of how the cupola operation is being conducted. The farther the curve lies from the probability shape, the poorer the operation.

It will be noticed immediately by one familiar with quality control that this analysis is readily applicable in the matter of calculating charges, provided, of course, that an accurate record of the materials has been kept. These records lead to empirical formulas which can be used to good advantage in quality control.

Letters to the Editor

Need New Approach to Foundry Training

During the war millions were spent on foundry plant expansion, but it was soon apparent manpower of the right type was a bottleneck. Today, while manpower is not so critical, it is of concern to efficient operation in our peacetime transition.

The speeded up training programs of war plants might be applied to training foundry workers. Some four year apprentice training courses are outmoded. It is difficult to attract foundry apprentices. Many companies lament the fact but are slow to correct the condition. Most young men are anxious to acquire a good paying job with the minimum of training. Every apprentice is not going to be a supervisor, so why not train molders, core-makers, melters, etc., in the shortest time. If an apprentice seems to be supervisor material, more time can well be spent on his education.

The average apprentice spends a few months of his four years in several departments. Some of this time can be cut down or eliminated. He is often the errand boy and the "odd job Joe" for everyone in sight. This contributes nothing to his foundry know-how and often discourages him. A new approach is needed in training foundry workers.

A sound program combining classroom work, demonstration, practice, and check-up might easily cut the training time to two years. Pattern shops usually operate under a more business-like atmosphere but still require a four to five year apprenticeship.

The problem seems to resolve itself into "do you want the apprentices to be mechanics or all-around foundrymen?" In mechanized foundries there are opportunities for both. In jobbing foundries the need seems to be more for the all-around man.

R. H. WILLIAMS, *Supt. of Foundries*
Canadian Westinghouse Co. Ltd.
Hamilton, Ontario

Selection of Trainees Important

On most occasions when discussion centers on foundry aprenticeship, a large segment of the foundry industry is forced to remain silent, because formal apprenticeship is absent from its operations.

This apparent apathy results from no lack of appreciation of either the necessity for or desirability of apprenticeship programs in the foundries where craftsmanship in molding, coremaking, and patternmaking is a requisite to successful operation. It comes rather as a consequence of measures taken in many foundries to engineer the skill of the craftsman out of the process and by mechanical means achieve the required result from workmen who need have only manual dexterity.

Since operatives of this latter type can be trained in a matter of days to the point where they can give creditable performances, any consideration of long training programs for such requirements is time wasted. The emphasis must be on ways of imparting job knowledge and use of work methods that lend themselves to reduction of training time.

Selection of trainees unquestionably merits more attention than it has been accorded, and as the understanding and application of aptitude testing improves, the problem of selecting applicants best suited for the job requirements should become more and more simple, especially in localities where the manpower supply is adequate.

Wherever vacancies must be filled by seniority-governed transfers from lower rated occupations, initial selection for employment assumes added importance.

The relatively rapid elevation to higher earning power furnishes all the incentive needed to induce the average untrained, unskilled worker to undertake a training course, and care usually has to be exercised to make sure that this potent economic incentive does not bring about further curtailment of training programs which have already been shortened to the absolute minimum.

It appears to us that all foundries have training problems, but in places where skilled craftsmen are needed the problem centers around *what* to teach the aprentice while in the other type of foundry the big question is *who* to teach. This does not mean that careful selection is not important in the choice of apprentices but rather that the training problem only begins at the start of the apprenticeship, whereas it is practically settled in the case of the trainee just as soon as that individual has been chosen.

W. J. MACNEILL, *General Manager*
G. H. R. Foundry
Dayton, Ohio

Responses to the question "How long does it take to train a foundry apprentice?", subject of the August issue "Round Table," indicated in general that a four year training period is preferred. The two letters above present additional points of view. *Editor.*

Likes Scheme for Faster Sand Analysis

The methods for faster sand analysis outlined by R. A. Willey and J. B. Caine ("Develop Chemical Methods for Faster Sand Analysis," AMERICAN FOUNDRYMAN, July 1948, pp. 50-56) are interesting and applicable to foundry sand control work.

Two important factors are involved in the methods. First, a direct method for each element or compound is advantageous if only two or three elements are to be checked. Second, the importance of proper sampling and analysis on both the clay and silica fractions,

unless past experience for a given sand indicates that this separation is unnecessary, is brought out. However, advantage may be taken of the combined method for certain elements if their determination is required. For example, an outline for the determination of alumina, iron oxide, calcium, oxide, magnesia and any TiO_2, Zr_2O_3, P_2O_5, and V_2O_5 is as follows:

Alumina—Treat duplicate one gram samples as outlined by Willey and Caine under "Alumina" (p. 54) to the point of dissolving the residue in HCl. If any appreciable amount of insoluble matter remains, filter, ignite, and fuse with the minimum amount of Na_2CO_3, dissolve the melt in an excess of dilute H_2SO_4 and if it contains SiO_2 add HF and evaporate to fumes of H_2SO_4, cool, dilute and add to the filtrate.

Precipitate the alumina on each one gram sample with NH_4OH, using a few drops of methyl red indicator. Filter, ignite, and weigh as Al_2O_3 plus Fe_2O_3. The precipitate will also contain the TiO_2, Zr_2O_3, P_2O_5 and V_2O_5.

If the latter oxides are present in quantities to be considered as having an important effect on the sand properties, treat only one of the two one gram samples for alumina; treat the other one gram sample with cupferron to precipitate the Fe_2O_3, TiO_2, ZrO_2, P_2O_5, and V_2O_5. Filter, ignite, and weigh. Subtract this weight from that of the NH_4OH precipitate to obtain the weight of Al_2O_3 plus any P_2O_5.

Iron Oxide—Determine the iron oxide on a separate sample as outlined on page 51 and subtract the weight of iron oxide found from the weight of the cupferron precipitation to determine the total amount of TiO_2, Zr_2O_3, P_2O_5, and V_2O_5 present.

If the total amount of TiO_2, Zr_2O_3, P_2O_5, and V_2O_5 is of no consequence, the cupferron precipitation may be eliminated or used for the iron determination. The weight of the iron oxide found as outlined on page 51 subtracted from the weight of the NH_4OH precipitate can be used to obtain the weight of Al_2O_3.

Calcium Oxide—Treat the ammoniacal filtrate from the alumina determination and finish for calcium oxide as outlined on page 52. Combine the filtrates on the duplicate samples if no cupferron separation was used.

Magnesia—Precipitate the magnesia from the filtrate of the calcium determination, and finish as $Mg_2P_2O_7$, or finish as outlined on page 55.

W. B. Sobers, *Met. Chemist*
Chain Belt Co.
Milwaukee, Wis.

Combined methods of analysis are a specialty of Mr. Sobers and he has described several of his methods in A.F.S. publications. His latest paper, "Analyzing Malleable Iron—A Rapid Method for Cr, Si, and Mn Determination," appeared in the September issue of *American Foundryman*, pp. 56-58. *Editor*.

Deserves Recognition as Old Timer

In the August 1948 issue of American Foundryman, page 69, you have failed to mention me as one of the oldtimers attending the 52nd A.F.S. Foundry Congress and have credited Fred W. Smale, National Malleable & Steel Castings Co., Cleveland, with my 51 years of service. We registered at the Old-Timers Booth together and when we came away we both had 50-year buttons. When Mr. Smale discovered this he turned his button in the next day for a 25-year button to which he is entitled.

George E. Mengele, *Supervisor*
Nat'l. Malleable & Steel Castings Co.
Cleveland

Sorry for the oversight. Your 51 years in the foundry industry are herewith recognized. *Editor*.

Yes, Mr. Dexter Would Have Been Ripe

We have just read with a great deal of interest the article "Colonial Foundries in the New World" in the Sept. 1948 American Foundryman. Noting that this is taken from the new A.F.S. publication, Development of the Metal Castings Industry, we would like to point out a typographical error.

On page 26, in the first paragraph under the heading "The Saugus Iron Works," the date 1863 is about 200 years too late. Mr. Dexter would have been rather ripe by that time to have been dug up and put in stocks.

Carter S. Cole, *Asst. Technical Sec.*
American Society for Testing Materials
Philadelphia.

It is good to note the interest ASTM takes in American Foundrymen's Society publications. The correct date, 1663, appears in the book. *Editor*.

Future Meetings and Exhibits

American Standards Association.—30th Annual Meeting, Waldorf-Astoria Hotel, New York—October 20-22.

Non-Ferrous Founders' Society, Annual Meeting, Warwick Hotel, Philadelphia—October 21-22.

American Institute of Mining and Metallurgical Engineers, Metals Division, Annual Meeting, Philadelphia—October 25-28.

American Society for Metals, 30th Annual National Metal Congress and Exposition, Convention Hall Philadelphia—October 25-29.

Society for Nondestructive Testing, Annual Convention, Philadelphia—October 27-28.

Metals Casting Conference, Purdue University, Lafayette, Indiana—November 4-5.

Meehanite Casting Manufacturers, Annual Meeting, Pittsburgh—November 11-13.

Steel Founders' Society of America, Fall Meeting, Hot Springs, Va.—November 15-16.

National Founders Association, Annual Meeting, Sheraton Hotel, Chicago—November 18-19.

American Society of Mechanical Engineers, Annual Meeting, Hotels Pennsylvania and New Yorker, New York—November 28-December 3.

Society for Experimental Stress Analysis, Annual Meeting, Hotel Commodore, New York.—December 2-4.

American Society for Metals, Sixth Western Metal Congress and Western Metal Exposition, Shrine Auditorium, Los Angeles.—April 11-15.

American Foundrymen's Society, 53rd Annual Foundry Congress, St. Louis—May 2-5, 1949.

WHO'S WHO

E. J. McAfee

E. J. McAfee, author of *"Reducing Casting Costs Via the Pattern Shop,"* Page 55, is best known for *The Patternmaker's Manual,* which he wrote in collaboration with R. G. M. Wagner . . . Descendant of a long line of foundrymen, Mr. McAfee became an apprentice patternmaker in Portland, Ore., and transferred to the Puget Sound Naval Shipyard just before World War I and has been there since . . . He was appointed master pattern maker at Puget Sound in 1938.

T. W. Curry

T. W. Curry, co-author with H. E. Henderson of *"Gray Iron Foundry Develops Resin Core Mixtures,"* Page 40, is widely-known for his frequent appearances as a speaker before A.F.S. chapters . . . Graduated with a B.S. in Metallurgical engineering from Pennsylvania State College in 1932, he joined Kennedy Van Saun Mfg. Corp., Danville, Pa., as metallurgist . . . Left there to take charge of foundry methods for the York Corp., York Pa., in 1936 . . . Returned to Kennedy Van Saun in 1938 as foundry superintendent . . . Rejoined the York Corp. in 1940 as assistant foundry superintendent . . . In 1943, Mr. Curry came to the Lynchburg Foundry Co., Lynchburg, Va., as plant metallurgist, his present position . . . At Lynchburg he has been instrumental in the development of chemical treatment of molding sand, and in the use of resin core mixtures, the subject of his article in this month's issue.

H. E. Henderson

Assisting Mr. Curry in this work is his co-author, Harvey E. Henderson, Lynchburg Plant Metallurgist . . . A graduate of Virginia Polytechnic Institute in 1936 with a B.S. in engineering, he received his master's degree from that institution in 1940 . . . Since then has worked for Standard Forgings Co., Mathieson Alkali Works, and Virginia Rubatex Co.

U. W. Smith

Utley W. Smith, author of *"Reduces Annealing Cycle—Malleable Foundry Develops Furnace Insulation Method,"* Page 52, is manager of the Magnesia Insulation Manufacturers Association . . . Holder of a B.S. degree in engineering and business administration from the Massachusetts Institute of Technology . . . Associated with Johns-Manville Corp. for several years as engineer in charge of manufacturing specifications . . . In 1942, Mr. Smith joined the War Production Board, first as assistant chief and later as chief of the Asbestos Section, where he assisted the Navy and Government agencies in the procurement of insulating materials. Upon termination of his work with the WPB, Mr. Smith took over his present position . . . He is now engaged in a series of studies on the economics of thermal insulation and is active both as a speaker and a writer.

R. W. Schroeder

Roy W. Schroeder, *("An Analysis of 1948 A.F.S. Apprentice Contest Entries")*, Page 34, is chairman of the A.F.S. Apprentice Contest Committee . . . Combining an extensive industrial and educational background, Mr. Schroeder has held positions in foundries in Galena, Rockford and Chicago, Illinois, and has taught foundry practice at the University of Illinois, Lewis Institute, and Crane Technical High School and Washburne Trade School, both of Chicago . . . He now teaches Foundry Practice at the Navy Pier Branch of the University of Illinois.

Four "newcomers" to the 25-year table at the Hamilton Foundry & Machine Co.'s Fourth Annual Service Award Dinner, held September 15, are shown with Company President Peter E. Rentschler (center), himself a 28-year Company veteran and recipient of this year's A.F.S. John A. Penton Gold Medal. The four quarter-century veterans who were awarded service pins and gold watches are, left to right: Joe Campos, blasting table operator; Fred Heffron, molder; Clem Henry, foreman, Clean and Ship department; and Miss Mary Weiss, secretary. (22 employees have 25 years' service).

A.F.S. DIRECTORY OF CHAPTERS

1948-49 OFFICERS AND DIRECTORS

Birmingham District Chapter

Chairman—Dr. J. T. MacKenzie, Tech. Dir., American Cast Iron Pipe Co.

Vice-Chairman—C. P. Caldwell, Pres., Caldwell Foundry & Machine Co., Inc.

Secretary-Treasurer—Fred K. Brown, Sales Mgr., Adams, Rowe & Norman, Inc.

Directors—Terms Expire 1949

Joseph T. Gilbert, Asst. to V.P., Stockham Pipe Fittings Co.
W. E. Jones, Chf. Engr., Stockham Pipe Fittings Co.
Fred S. Middleton, Jr., V.P., Production Foundries Div., Jackson Industries, Inc.
J. A. Woody, Gen. Supt., American Cast Iron Pipe Co.

Directors—Terms Expire 1950

Donald C. Abbott, Serv. Eng., Hill & Griffith Co.
D. C. McMahen, Slsmn., Harbison-Walker Refractories Co.
J. Paul Singleton, Wks. Mgr., Central Foundry Co., Holt.

Directors—Terms Expire 1951

J. A. Bowers, Melting Supt., American Cast Iron Pipe Co.
Clyde E. Hagler, V.P., Continental Gin Co.
B. W. Worthington, Dev. Engr., McWane Cast Iron Pipe Co.

British Columbia Chapter

Chairman—Thomas Cowden, Gen. Mgr., Wm. McPhail & Sons (Can.) Ltd., Vancouver.

Vice-Chairman—J. A. Dickson, Owner, Dickson Fdry. Co., Vancouver.

Secretary-Treasurer—L. P. Young, Met., A-1 Steel & Iron Foundry Ltd., Vancouver.

Directors—Terms Expire 1949

J. Graham, Ass't. Mgr., Mainland Foundry Co., Ltd., Vancouver.
H. Heaton, Fdry. Supt., Heaps Engrg. (1940) Ltd., New Westminster.

Directors—Terms Expire 1950

E. C. Bird, Chg. of Oprs., Major Aluminum Products Ltd., Vancouver.
F. Coltart, Prop., Maple Leaf Pattern Works, Vancouver.

Directors—Terms Expire 1951

W. M. Armstrong, Prof., Dept. Mining & Metallurgy, University of British Columbia, Vancouver.
Fred Bay (Retired), Vancouver.

Canton District Chapter

Chairman—Edw. H. Taylor, Plant Engr., F. E. Myers & Bros. Co., Ashland.

Vice-Chairman—Geo. M. Biggert, Met. Res. Dept., United Engineering & Foundry Co., Canton.

Secretary—Robt. L. Fasig, Asst. Works Mgr., Ashland Malleable Iron Co., Ashland.

Treasurer—Otis Clay, Owner, Tuscora Foundry Sand Co., Canal Fulton.

Directors—Terms Expire 1949

Thos. W. Harvey, Chief Engr., The Pitcairn Co., Pittsburgh Valve & Fitting Div., Barberton.
C. E. Shaw, Wks. Engr., American Steel Fdries., Alliance.

Directors—Terms Expire 1950

J. W. Fairburn, Ashland Malleable Iron Co., Ashland.
Nils E. Moore, Wadsworth Testing Laboratories, Canton.
H. G. Stevener, American Steel Foundries, Alliance.

Directors—Terms Expire 1951

F. K. Donaldson, Vice Pres., Machined Steel Casting Co., Alliance.
Robert Cairnie, Owner, The Orville Bronze & Alum. Co., Orville.
Charles Reyman, Jr., Fdry. Supt., Atlantic Foundry Co., Akron.

Central Illinois Chapter

Chairman—F. W. Shipley, Factory Mgr., Caterpillar Tractor Co., Peoria.

Vice-Chairman—Chas. W. Bucklar, Jr., Supt., Superior Foundry Co., East Peoria.

Secretary-Treasurer—Vern W. Swango, Frm., Caterpillar Tractor Co., Peoria.

Directors—Terms Expire 1949

A. V. Martens, Pres., Pekin Foundry & Mfg. Co., Pekin.
L. E. Roby, V.P., Peoria Malleable Castings Co., Peoria.
F. W. Shipley, Caterpillar Tractor Co., Peoria.

Directors—Terms Expire 1950

Zigmond Madacey, Fdry Supt., Caterpillar Tractor Co., Peoria.
John M. McCarthy, Jr., V. P., South Side Foundry, Peoria.

Directors—Terms Expire 1951

E. J. Burns, Pres., Illini Foundry Co., Peoria.
C. B. Soper, V.P., Amer. Fdry. & Furnace Co. Bloomington.

Central Indiana Chapter

Chairman—Robert Langsenkamp, Sec'y., Langsenkamp-Wheeler Brass Works, Indianapolis.

Vice-Chairman—Howard L. Creps., Res. Sls. Mgr., Frank Foundries Corp., Muncie, Ind.

Secretary—Jack W. Giddens, International Harvester Co., Indianapolis.

Treasurer—Paul V. Faulk, Electric Steel Castings Co., Indianapolis.

Directors—Terms Expire 1949

Ray S. Davis, Mgr., National Malleable & Steel Castings Co., Indianapolis.
Ray Fickenworth, Gen Mgr., C & G Foundry & Pattern Works, Inc., Indianapolis.
Allen J. Reid, Sls. Mgr., General Refractories Co., Indianapolis.
Robert Coady, Plant Engr., Hoosier Iron Works, Kokomo.

Directors—Terms Expire 1950

Fred Carl, Met., Central Foundry Division, General Motors Corp., Danville, Ill.
C. B. Juday, Plant Engr., Perfect Circle Co., New Castle.
J. P. Lentz, Fdry. Met., International Harvester Co., Indianapolis.
William Mitchell, Owner, L. W. & W. K. Mitchell Co., Indianapolis.

Directors—Terms Expire 1951

Paul Hargitt, Sr., Pres., Light Metals, Inc., Indianapolis.
Wm. Ziegelmueller, V.P. and Gen. Mgr., Electric Steel Castings Co., Indianapolis.
Carl Schopp, Fdry. Supt., Link Belt Co., Indianapolis.
Franklin Swain, Pur. Agt., Golden Foundry Co., Columbus.

Central Michigan Chapter

Chairman—C. C. Sigerfoos, Assoc. Prof. of Mech. Engrg., Michigan State College, East Lansing.

Vice-Chairman—Fitz Coghlin, Jr., Met., Albion Malleable Iron Co., Albion.

Secretary-Treasurer—George Petredean, Treas., Calhoun Foundry Co., Homer.

Directors—Terms Expire 1949

Oral J. Drumm, Fdry. Mgr., Battle Creek Bread Wrapping Machine Co., Battle Creek.
A. E. Rhoads, Pres., Engineering Castings, Inc., Marshall.
John E. Wolf, Plant Mgr., Midwest Foundry Co., Coldwater.

Directors—Terms Expire 1950

Jack Durr, Tech Adv. & Met., Albion Malleable Iron Co., Albion.
Edwin Doerschler, Pres., U. S. Foundry Corp., Kalamazoo.
Douglas J. Strong, Pres., Foundries Materials Co., Coldwater.

Directors—Terms Expire 1951
Collins L. Carter, Pres. & G.M., Albion Malleable Iron Co.
C. W. Dock, Pres. & Mgr., Dock Foundry Co., Three Rivers.
Jack F. Secor, Hill & Griffith Co., Niles.

Central New York Chapter

Chairman—Curtis M. Fletcher, Supt., Fairbanks Co., Binghamton.
Vice-Chairman—J. F. Livingston, Ass't. Plant Mgr., Crouse-Hinds Co., Syracuse.
Secretary—David Dudgeon, Jr., Plant Engr., Utica Radiator Co., Utica.
Treasurer—Wm. Dunn, Asst. to Pres., Oberdorfer Foundries, Utica.
Directors—Terms Expire 1949
D. J. Merwin, V.P., Oriskany Malleable Iron Co., Inc.
Wm. G. Parker, Sand Tech., General Electric Co., Elmira Works, Elmira.
E. G. White, Plant Engr., Crouse-Hinds Co., Syracuse.
Directors—Terms Expire 1950
A. S. Bowen, Supv., Goulds Pumps, Inc., Seneca Falls.
J. Francis Dobbs, Met., New York Air Brake Co., Watertown.
E. E. Hook, Sales Engr., Dayton Oil Co., Syracuse.
Directors—Terms Expire 1951
Joseph Gibson, Supt., Sweets Foundry, Inc., Johnson City.
R. A. Minnear, Fdry. Supt., Ingersoll-Rand Company, Painted Post.
R. C. S. Potter, Gen. Mgr., Chemung Foundry, Elmira.

Central Ohio Chapter

Chairman—Fred W. Fuller, Field Engr., National Engineering Co., Westerville.
Vice-Chairman—Walter L. Deutsch, Sales Engr., Columbus Malleable Iron Co., Columbus.
Secretary—Daniel E. Krause, Exec. Dir., Gray Iron Research Institute, Columbus.
Treasurer—William T. Bland, Supt., Commercial Steel Casting Co., Marion.
Directors—Terms Expire 1949
Robert Willey, Met., Commercial Steel Casting Co., Marion.
R. E. Fisher, Pres., Bonney Floyd Co., Columbus.
C. O. Briner, Fdry. Supt., Jaeger Machine Co., Columbus.
Director—Term Expires 1950
E. M. Durstine, Mgr., Keener Sand & Clay Co., Columbus.
Directors—Terms Expire 1951
C. T. Greenidge, Res. Met., Battelle Memorial Institute Columbus.
J. Gray Lummis, Dist. Mgr., A. P. Green Fire Brick Co., Columbus.

Chesapeake Chapter

Chairman—Blake M. Loring, Head Non.Fer.Sec., U.S. Naval Research Lab., Washington, D.C.
Vice-Chairman—J. B. Mentzer, Sec'y.-Treas., Wood-Embly Brass Co., Waynesboro, Pa.
Secretary-Treasurer—Clausen A. Robeck, V.P., & Supt., Gibson & Kirk Co., Baltimore, Md.
Technical Secretary—Wm. H. Baer, Assoc. Met., Naval Research Laboratory, Washington, D. C.
Directors—Terms Expire 1949
A. A. Hochrein, Dist. Mgr., Federated Metals Div., American Smelting & Refining Co., Baltimore, Md.
James J. Lacy, V.P., James J. Lacy Co., Baltimore, Md.
Allen S. Kittrell, Owner, The Leach Pattern Shop, Baltimore, Md.
Directors—Terms Expire 1950
L. Earl Gaffney, V.P., Arlington Bronze & Alum. Corp. Baltimore, Md.
Orville H. Scheel, Chem., American Hammered Piston Ring Div., Koppers Co., Baltimore, Md.
Lewis H. Gross, American Radiator & Standard Sanitary Corp., Baltimore.
Directors—Terms Expire 1951
L. H. Denton, Baltimore Convention Bureau, Baltimore, Md.
Frank B. Gately, Ass't. Sec'y., Flynn Emrich Co., Baltimore.
Wm. H. Holtz, Supt., American Brake Shoe Co., Baltimore.

Chicago Chapter

Chairman—C. K. Faunt, Wks. Mgr., Christensen & Olsen Fdry. Co.
Vice-Chairman—W. D. McMillan, Met., Int'ntl. Harvester Co.
Secretary—Victor M. Rowell, Tech. Sls. Repr., Velsicol Corp.
Treasurer—Bruce L. Simpson, Pres., National Engineering Co.
Directors—Terms Expire 1949
J. C. Gore, Chicago Mgr., Werner G. Smith Co.
D. H. Lucas, Mfrs. Representative.
H. K. Swanson, Owner, Swanson Pattern & Model Works, East Chicago, Ind.
Chester V. Nass, Mgr. Fdry. Div., Pettibone-Mulliken Corp.
Directors—Terms Expire 1950
G. W. Anselman, Serv. Engr., Goebig Mineral Supply Co.
W. B. George, Fdry. Engr., R. Lavin & Sons, Inc.
Rob't. M. Jones, Supt. of Fdries., Carnegie-Illinois Steel Corp.
Laurence H. Hahn, Met. Supv., Sivyer Steel Casting Co.
Directors—Terms Expire 1951
Roy Frazier, Fdry. Consultant, Love Bros., Inc., Aurora.
Alfred W. Gregg, Exec. Engr., Whiting Corp., Harvey.
Martin Rintz, Fdry. Supt., Continental Foundry & Machine Co., East Chicago, Ind.
Fred B. Skeates, Fdry. Supt., Link Belt Co.

Cincinnati District Chapter

Chairman—J. D. Judge, Wks. Engr., Hamilton Foundry & Machine Co., Hamilton.
Vice-Chairman—Walter J. Klayer, Aluminum Industries, Inc.
Secretary—B. A. Genthe, Mgr., S. Obermayer Company.
Treasurer—Chas. S. Dold, Asst. Mgr. Coke Sales, Portsmouth Steel Corp.
Assistant Treasurer—Walter A. Funck, Gen. Supt., The Reliance Foundry Co.
Directors—Terms Expire 1949
Geo. A. Avril, Pres., G. A. Avril Smelting Works.
Chas. S. Dold.
C. H. Fredericks, Met., Cincinnati Milling Machine Co.
Walter A. Funck.
Earl K. Kindinger, Fdry. Engr., Williams & Co., Inc.
Paul Ziegler, G.M., H. P. Deuscher Co., Hamilton.
Directors—Terms Expire 1950
Arthur L. Grim, Supt. of Fdry. The Dayton Malleable Iron Co., Dayton.
J. D. Judge.
Walter J. Klayer.
Alfred W. Schneble, Jr., Plt. Mgr., Advance Foundry Co., Dayton.
Directors—Terms Expire 1951
B. A. Genthe.
R. E. Ashburn, Supt., Sawbrook Steel Castings Company.
Geo. A. Euskirchen, Pres., Cincinnati Foundry Company.
J. H. Pearson, Chf. Ind. Engr., Williamson Heater Company.
A. W. Schlegel, Mgr., Ideal Pattern Works, St. Bernard.
Russell S. Whitehead, Field Engr., Electro Refractories and Alloys Corp.

Detroit Chapter

Chairman—A. W. Stolzenburg, Aluminum Co. of America.
Vice-Chairman—R. J. Wilcox, Chf. Met., Michigan Steel Castings Co.
Secretary—Julian N. Phelps, Fdry. Met., Vanadium Corp. of America.
Treasurer—George A. Fuller, Jr., Branch Mgr., Federal Foundry Supply Co.
Directors—Terms Expire 1949
Pierce Boutin, Fdry. Frm., Pontiac Motor Div., General Motors Corp., Pontiac.
J. Edward Coon, Prod. Met., Fdry. Dept., Packard Motor Car Co.
R. L. Orth, Sales Engr., American Wheelabrator Equipment Co.
W. N. Seese, Serv. Engr., J. S. McCormick Co.
Directors—Terms Expire 1950
Elmer J. Heiden, Riley Stoker Corp.
Ernest J. Rousseau, Pres., Commerce Pattern Foundry & Machine Co.
Claude B. Schneible, Pres., Claude B. Schneible Co.

Edward H. Stilwill, Met., Dodge Div., Chrysler Corp.

Directors—Terms Expire 1951

W. C. Morgan, E. F. Houghton & Co.

Vaughan C. Reid, V. P., City Pattern Foundry & Machine Co.

Jess Toth, Sec'y., Harry W. Dietert Co.

M. W. Warchol, Met., Atlas Foundry Co.

Eastern Canada and Newfoundland Chapter

Chairman—O. L. Voisard, Gen. Supt., The Robert Mitchell Co., Ltd., Ville St. Laurent, Quebec.

Vice-Chairman—James H. Newman, Sales Repr., Newman Foundry Supply Ltd., Montreal, Quebec.

Secretary—J. G. Hunt, Fdry. Met., Dominion Engineering Works Ltd., Montreal, Quebec.

Treasurer—L. Guilmette, Treasurer, Canadian Foundry Supplies & Equip. Ltd., Montreal, Quebec.

Directors—Terms Expire 1949

Wm. L. Bond, Prop., Bond Brass Ltd., Eastview, Ontario.

C. C. Brisbois, Fdry Consultant, Montreal, Quebec.

W. J. Brown, Mgr., Robert W. Bartram, Ltd., Montreal, Que.

H. E. Francis, Pattern Frm., Jenkins Brothers, Ltd., Montreal Quebec.

John Shewan, Wheel Fdry. Frm., Canadian Car & Fdry. Co., Ltd., Turcot Works, Montreal, Quebec.

Directors—Terms Expire 1950

Rene Belisle, Wks. Mgr., J. A. Gosselin Co. Ltd., Drummondville, Quebec.

W. E. Hillis, V.P. & Fdry. Mgr., Hillis & Sons, Ltd., Halifax N.S.

James Grieve, Fdry. Supt., Dominion Engineering Works, Ltd., Lachine, Quebec.

M. A. Hughes, Indus. Slsman., LaSalle Coke Co., Montreal, Quebec.

W. Turney Shute, Inspector, Canadian Car & Foundry Co. Ltd., Westmount, Quebec.

Directors—Terms Expire 1951

Lucien Beaudry, Factory Engr., Warden King Ltd., Montreal, Quebec.

H. T. Doran, Eastern Repr., Whiting Corporation (Canada) Ltd., Montreal, Quebec.

A. Jack Moore, District Mgr., Montreal Bronze Ltd., Montreal, Quebec.

J. E. Roberge, V.P., Hardware & Woodenware, Inc., Coaticook, Quebec.

Alex Watson, Foundry Foreman, Canadian National Railways, Montreal, Quebec.

Eastern New York Chapter

Chairman—Alexander C. Andrew, Fdry. Frm., American Locomotive Co., Schenectady.

Vice-Chairman—Kenneth F. Echard, Met., Eddy Valve Company, Waterford.

Secretary-Treasurer—Ugo Navarette, Frm., General Electric Co., Schenectady.

Directors—Terms Expire 1949

Scott Mackay, Rensselaer Polytechnic Institute, Troy.

Theodore O. Carlson, Fdry Frm., General Electric Co.

Kenneth Mason, Fdry. Engr., Albany Casting Co., Inc.

Directors—Terms Expire 1950

Leonard Nelson, Supt., Ludlow Valve Co., Troy.

Leo Scully, Mgr., Scully Foundry & Machine Co., Coxsackie.

Jasper N. Wheeler, Pres., Wheeler Brothers Brass Foundry, Troy.

Directors—Terms Expire 1951

Reginald DeVarennes, Plant Mgr., Rensselaer Valve Co., Troy.

Roy Garrison, V.P., Adirondack Foundries & Steel Co., Watervliet.

Paul Wilson, Supt., James Hunter Machine Co., North Adams, Mass.

Metropolitan Chapter

Chairman—John A. Bukowski, Works Met., Worthington Pump & Mach. Corp., Harrison, N.J.

Vice-Chairman—Thomas J. Wood, Fdry. Supt., American Brake Shoe Co., Mahwah, N.J.

Secretary—J. Fred Bauer, Slsmn., Hickman, Williams & Co., New York, N.Y.

Treasurer—D. Polderman, Jr., V.P., & Export Mgr., Whiting Corp., New York, N.Y.

Directors—Terms Expire 1949

R. A. Flinn, Jr., Met., American Brake Shoe Co., Mahwah, N.J.

William F. Rose, Sales Mgr., Thor Products Casein Co. of America, New York, N.Y.

R. D. Speirs, Pattern Supt., Wright Aeronautical Co., Wood Ridge, N.J.

D. W. Talbot, Gen. Mgr., Cooper Alloy Foundry Co., Hillside, N.J.

J. S. Vanick, Met., International Nickel Co., Inc., New York, N.Y.

Directors—Terms Expire 1950

Frank B. Eliason, Pennsylvania Foundry Supply & Sand Co., Philadelphia.

Ernest R. Miller, Fdry. Supt., Bethlehem Steel Co., Staten Island, N.Y.

John Van Haver, Worthington Pump & Machinery Corp., Harrison, N.J.

Robert G. Pitz, Hahn-Pitz Foundries, Inc., Brooklyn, N. Y.

Aubrey E. Winsted, Wks. Mgr., Moore Brothers Co., Elizabeth, N. J.

Mexico City Chapter

President—Ing. F. Fernando Gonzales Vargas, Consulting Metallurgist, 2 da. Privada Concepcion Beistegui No. 14, Mexico, D.F., Mexico.

Vice-President—Pedro Quintanilla D., Industrial de San Bartolo, San Bartolo Naucalpan, Mexico.

Secretary—N. S. Covacevich, Apartado 1030, Mexico, D.F., Mexico.

Treasurer—David E. Stine, Fundiciones de Hierro y Acero, S.A., San Pedro de los Pinos, Mexico, D.F., Mexico.

Directors—Ing. Ricardo Menendez, International Nickel, Inc., Credito Minero, Mexico, D.F., Mexico.

Alfredo Cruz, Fundiciones de Hierro y Acero, S.A., San Pedro de los Pinos, Mexico, D.F., Mexico.

Michiana Chapter

Chairman—K. A. Nelson, Branch Mgr., Chicago Hardware Foundry Co., Elkhart, Ind.

Vice-Chairman—John Rush, Supt., Elkhart Brass Mfg. Co., Elkhart, Ind.

Secretary-Treasurer—V. S. Spears, Sales Engr., American Wheelabrator & Equip. Corp., Mishawaka, Ind.

Directors—Terms Expire 1949

Wm. Ferrell, Gen. Wks. Supt., Auto Specialties Mfg. Co., St. Joseph, Mich.

George Garvey, Patt. Frm., City Pattern & Foundry Co., Inc., South Bend, Ind.

Stanley F. Krzeszewski, Factory Mgr., American Wheelabrator & Equip. Corp., Mishawaka, Ind.

Howard B. Voorhees, Fdry. Supt., Peru Foundry, Peru, Ind.

Directors—Terms Expire 1950

A. J. Edgar, Wks. Mgr., Benton Harbor Malleable Industries, Inc., Benton Harbor, Mich.

W. J. Freyer, Weil-McLain Co., Michigan City, Ind.

W. F. Lange, Jr., V.P., Casting Service Corp., LaPorte, Ind.

F. T. McGuire, Met., Sibley Machine & Fdry. Corp., South Bend, Ind.

Directors—Terms Expire 1951

Noel E. Baker, Sales Mgr., Star Pattern & Mfg. Co., Benton Harbor, Mich.

J. Paul Jordan, Fdry. Engr., Dodge Mfg. Corp., Mishawaka, Ind.

Andrew Peterson, Mall. Frm., Oliver Farm Equipment Co., South Bend, Ind.

E. S. Wegenke, Labor Supt., Sibley Machine & Foundry Corp., South Bend, Ind.

Northeastern Ohio Chapter

President—Walter E. Sicha, Met., Aluminum Co. of America, Cleveland.

Vice-President—William G. Gude, Managing Editor, *The Foundry*, Cleveland.

Secretary—R. D. Walter, Chem., Werner G. Smith Co., Cleveland.

Treasurer—F. Ray Fleig, Pres., Smith Facing & Supply Co., Cleveland.

Directors—Terms Expire 1949

F. L. Barton, Fulton Foundry & Machine Co., Cleveland.
Fred J. Pfarr, Plant Mgr., Lake City Malleable Co., Cleveland.
Vincent J. Sedlon, Owner, Master Pattern Co., Cleveland.
C. S. Winter, Pres., Duplex Mfg. and Foundry Co., Elyria.

Directors—Terms Expire 1950

Gerald M. Cover, Prof. of Met. Engrg., Case Institute of Technology, Cleveland.
E. G. Fahlman, Pres., The Permold Co., Medina.
Gilbert J. Nock, V.P., Nock Fire Brick Co., Cleveland.
John Schneider, Industrial Sls. Dept., Cleveland Electric Illuminating Co.
John M. Urban, Fdry. Supt., Fanner Mfg. Co., Cleveland.

Directors—Terms Expire 1951

Lewis T. Crosby, Dist. Mgr., Sterling Wheelbarrow Co., Cleveland.
Lloyd W. Leesburg, Supv., Superior Foundry, Inc., Cleveland.
Henry C. LeBeau, Met., Ohio Injector Co., Wadsworth.
Maurice F. Degley, Engr., Ferro Machine & Foundry Co., Cleveland.
John A. Sharritts, Westinghouse Electric Co., Cleveland.

Northern California Chapter

President—George McDonald, Prod. Mgr., H. C. Macauley Foundry Co. Berkeley.

Vice-President—J. L. Francis, Vulcan Steel Foundry, Oakland.

Secretary—Charles R. Marshall, Dist. Mgr., Chamberlain Co., Oakland.

Treasurer—Fred Mainzer, Mgr., Pacific Brass Fdry. of San Francisco, San Francisco.

Directors—Terms Expire 1949

William Butts, Gen. Mgr., General Metals Corp., Oakland.
H. Milton Nystrom, Sales Mgr., Production Pattern Works, Oakland.
John R. Russo, V.P., General Foundry Service Corp., Oakland.
Roy C. Wendelbo, Management Supt., De Sanno Foundry & Machine Co., Oakland.

Directors—Terms Expire 1950

John Bermingham, E. F. Houghton & Co., San Francisco.
Eldo Finley, Supt., San Francisco Iron Foundry, San Francisco.
Philip C. Rodger, Frm., General Metals Corp., Oakland.
William F. U'Ren, Slsmn., Columbia Steel Co., San Francisco.

Northern Illinois-Southern Wisconsin Chapter

Chairman—H. J. Bauman, Fdry. Supt., Ebaloy Foundries, Inc., Rockford, Ill.

Vice-Chairman—Lester C. Fill, Fdry. Supt., Geo. D. Roper Corp., Rockford, Ill.

Secretary—F. W. Thayer, Ass't. Wks. Mgr., Gunite Foundries Corp., Rockford, Ill.

Treasurer—Carl Dahlquist, Fdry. Tech., Greenlee Bros. & Co., Rockford, Ill.

Directors—Terms Expire 1949

John R. Cochran, Fdry. Frm., J. I. Case Co., Inc., Rockford, Ill.
John A. Forbes, Exec. V.P., Gunite Foundries Corp, Rockford.
Leon S. Hull, Fdry. Frm., Beloit Foundry Co., Beloit, Wis.

Directors—Terms Expire 1950

Lyle Fulton, Frm. Pattern Shop, Geo. D. Roper Corp., Rockford, Ill.
Jack Rundquist, Co-Owner, Beloit Casting Co., Beloit, Wis.
Bruce Whiting, Chf. Engr., Woodmanse Mfg. Co., Freeport, Ill.

Directors—Terms Expire 1951

Upton Bartlett, Treas., Alloy Castings, Inc.,. Rockford, Ill.
John T. Clausen, Fdry. Engr., Greenlee Bros. & Co., Rockford.
Ralph M. Lightcap, Mgr., Rupp Pattern Co., Rockford, Ill.

Northwestern Pennsylvania Chapter

Chairman—J. S. Hornstein, Sec'y., Meadville Malleable Iron Co., Meadville.

Vice-Chairman—Jos. A. Shuffstall, Plant Mgr., National Erie Corp., Erie.

Secretary—Reginald Harding, Pickands-Mather Co., Erie.

Treasurer—Frank P. Volgstadt, Fdry. Supt., Griswold Mfg. Co., Erie.

Directors—Terms Expire 1949

John E. Gill, Supt., Lake Shore Pattern Works, Erie.
J. Douglas James, Cooper Bessemer Corp.
George Johnstone, Jr., Pres. & G.M., Johnstone Foundries, Inc., Grove City.

Directors—Terms Expire 1950

Fred Carlson, Fdry. Frm., Weil-McLain Co., Erie.
James J. Farina, American Sterilizer Co., Erie.
Bailey D. Herrington, Serv. Tech., Hickman, Williams & Co., Inc., Erie.

Directors—Terms Expire 1951

John W. Clarke, Asst. Supt. of Foundries, General Electric Co., Erie.
Clyde Cooper, Fdry. Supt., Keystone Brass Works, Erie.
Harold G. Lolley, Fdry. Supt., Bucyrus-Erie Co., Erie.
J. M. Morrison, Pattern Shop Frm., U. S. Radiator Corp., Fredonia, N. Y.

Ontario Chapter

Chairman—R. A. Woods, Mgr., Geo. F. Pettinos, (Canada), Ltd., Hamilton, Ont.

Vice-Chairman—J. H. King, Slsmn., Werner G. Smith Co., Ltd., Toronto, Ont.

Secretary-Treasurer—G. L. White, Adv. Mgr., Westman Publications, Ltd., Toronto, Ont.

Directors—Terms Expire 1949

M. N. Tallman, A. H. Tallman Bronze Co., Ltd., Hamilton.
C. O. Flowers, Supt., Canada Iron Foundries, Ltd., Hamilton.
A. E. Bock, Standard Castings & Mfg. Co., Galt, Ont.

Directors—Terms Expire 1950

Neil Kennedy, William Kennedy & Sons, Ltd., Owen Sound, Ont.
R. T. Wilson, Asst. Plant Supt., Ontario Malleable Iron Co., Ltd., Oshawa, Ont.
R. H. Williams, Supt. of Fdries, Canadian Westinghouse Co., Ltd., Hamilton, Ont.

Directors—Terms Expire 1951

Jack Richardson, United Smelting & Refining Co., Hamilton.
A. C. Boak, Supt. of Fdries., Non-Ferrous Castings Co., Toronto.
A. Reyburn, Supt. of Fdries., Massey-Harris Co., Ltd., Brantford, Ont.

Immediate Past Chairman to serve on Board for one year:

J. Dalby, Mgr., Wilson Brass & Aluminum Foundry, Toronto.

Oregon Chapter

Chairman—J. Otis Grant, Electric Steel Foundry Co., Portland.

Vice-Chairman—C. Neal Wilcox, Ass't. Fdry. Supt., Electric Steel Foundry Co., Portland.

Secretary-Treasurer—Geo. C. Vann, Ass't Mgr., Northwest Foundry & Furnace Co., Portland.

Directors—Terms Expire 1949

A. B. Holmes, Supt., Crawford & Doherty Foundry Co., Portland.
H. L. Tatham, Supt., Pacific Steel Foundry Co., Portland.

Directors—Terms Expire 1950

J. Otis Grant (See Chairman).
Lee E. Holcomb, Ass't. to Supt., Crawford & Doherty Foundry Co., Portland.
Harry K. McAllister, Patt. Shop Frm., Western Foundry Co., Portland.

Directors—Terms Expire 1951

Harold A. Story, Supt., Oregon Brass Works, Portland.
George C. Vann (See Secy.-Treas.).
C. Neal Wilcox (See Vice-Chairman).

Philadelphia Chapter

Chairman—C. L. Lane, Met., Florence Pipe Foundry & Machine Co., Florence, N. J.

Vice-Chairman—W. A. Morley, Fdry. Mgr., Olney Foundry Div., Link-Belt Co.

Secretary-Treasurer—W. B. Coleman, Pres., W. B. Coleman & Co.

Directors—Terms Expire 1949

A. C. Gocher, Foundry Superintendent, Fletcher Works, Inc.
Hermann P. Good, Supt., Textile Machine Works, Reading.

Directors—Terms Expire 1950

C. B. Jenni, Metallurgist, General Steel Castings Corp.
W. B. Wilkins, President and General Manager, American

Manganese Bronze Co.

Directors—Terms Expire 1951

J. L. Furey, Sales Engr., Swan-Finch Oil Corp., Cheltenham.
George Bradshaw, Master Molder, Philadelphia Navy Yard.

Quad City Chapter

Chairman—M. H. Liedtke, Fdry. Supt., Farmall Works, International Harvester Co., Rock Island, Ill.

Vice-Chairman—E. P. Closen, Gen. Fdry. Frm., John Deere Planter Works, Moline, Ill.

Secretary-Treasurer—C. R. Marthens, Owner, Marthens Co., Moline, Ill.

Directors—Terms Expire 1949

A. D. Matheson, Works Mgr., French & Hecht, Davenport, Iowa.
A. H. Putnam, Owner, A. H. Putnam Company, Rock Island, Ill.
R. H. Swartz, Gen. Mgr., Riverside Foundry, S. & W. Foundry Corp., Bettendorf, Iowa.
C. L. Briceland, Materials Supply Supv., J. I. Case Company, Bettendorf, Iowa.

Directors—Terms Expire 1950

Wm. C. Bell, Prod. Engr., Frank Foundries Corp., Moline, Ill.
H. L. Mead, Gen. Fdry. Frm., John Deere Harvester Works East Moline, Ill.
H. A. Rasmussen, Pres., General Pattern Corp., Moline, Ill.

Directors—Terms Expire 1951

C. S. Humphrey, Pres., C. S. Humphrey Company, Moline, Ill.
J. O. Nelson, Supt., Mississippi Foundry Corporation, Rock Island, Ill.
R. E. Wilke, Met., Deere & Company, Moline, Ill.

Rochester Chapter

President—Max T. Ganzauge, Fdry. Supt., General Railway Signal Co.

Vice-President—Herman Hetzler, Pres., Hetzler Foundries, Inc.

Secretary-Treasurer—Leon C. Kimpal, Engr., Rochester Gas & Electric Corp.

Directors—Terms Expire 1949

Edward J. Baker, Branch Mgr., American Smelting & Refining Co.
L. C. Gleason, Fdry. Supt., Gleason Works.
Jack Steeves, Partner, Corbett-Steeves Pattern Works.
Herbert G. Stellwagen, Off. Mgr., Hetzler Foundry.

Directors—Terms Expire 1950

Fred E. Adsit, Patt. Frm., Ingersoll-Rand Co., Painted Post.
Charles E. Vaughn, Supt. of Fdries, Ritter Co., Inc.

Directors—Terms Expire 1951

Fred Gehron, Supt., Southern Wheel Div., American Brake Shoe Co.
Kenneth Proud, Office Mgr., Antice Co., Inc.
William Richter, Fdry. Frm., Gleason Works.

Saginaw Valley Chapter

Chairman—Oscar E. Sundstedt, V.P. & G.M., General Foundry & Mfg. Co., Flint.

Vice-Chairman—L. L. Clark, Plant Met., Buick Motor Div., Flint

Secretary-Treasurer—Raymond H. Klawuhn, Acc't., General Foundry & Mfg. Co., Flint.

Directors—Terms Expire 1949

D. D. Bowman, Office Mgr., Almont Mfg. Co., Almont.
Robert Calkins, V.P., Clio Foundry Co., Clio.
L. A. Cline, Sec'y., Saginaw Foundries Co., Saginaw.

Directors—Terms Expire 1950

M. C. Godwin, Ass't. Supt., Bostick Fdry. Co., Lapeer.
C. A. Tobias, Head Science Dept., General Motors Institute, Flint.
Howard H. Wilder, Chf. Met., Eaton Mfg. Co., Vassar.

Directors—Terms Expire 1951

Albert E. Edwards, Gen. Frm., Chevrolet Grey Iron Fdry., Saginaw.
Norman J. Henke, Process Supt., Saginaw Malleable Iron Plant, Saginaw.
Frederick Kent, Ass't. Supt., Buick Motor Div., General Motors Corp., Flint.

St. Louis District Chapter

Chairman—A. L. Hunt, Plant Supt., National Bearing Div., American Brake Shoe Co.

Vice-Chairman—George N. Shepherd, Supt., Duncan Foundry & Machine Co., Alton, Ill.

Secretary—Paul E. Retzlaff, Fdry. Mgr., Busch-Sulzer Bros. Diesel Engine Co., Div. Nordberg Mfg. Co.

Treasurer—Henry W. Meyer, Sand Res. Tech., General Steel Casting Co.

Directors—Terms Expire 1949

E. J. Aubuchon, Pres., M. A. Bell Co.
Albert S. Hard, Supt., St. Louis Steel Casting Co.
Walter E. Illig, V.P., Banner Iron Works.
Charles E. Rothweiler, Slsmn., Hickman, Williams & Co., Inc.

Directors—Terms Expire 1950

F. W. Burgdorfer, Pres., Missouri Pattern Co.
Gordon McMillan, Met., General Steel Casting Corp., Commonwealth Plant, Granite City, Ill.
Charles F. Rohlkoetter, Gen. Frm., American Steel Foundries.
R. E. Woods, Treas., M. W. Warren Coke Co.

Directors—Terms Expire 1951

J. F. Gilbert, Pres., Gilbert Brass Foundry Co.
N. L. Peukert, Supv. Cupola Melting, Carondelet Foundry Co.
Carl A. Pfanstiel, Works Mgr., Fulton Iron Works Co.
Walter A. Zeis, Walter A. Zeis Co., Webster Groves, Mo.

Southern California Chapter

President—L. O. Hofstetter, Brumley-Donaldson Co., Los Angeles.

Vice-President—Earle D. Shomaker, Pattern Shop Frm., Kay-Brunner Steel Products, Inc., Alhambra.

Secretary—John E. Wilson, Met. Engr., Climax Molybdenum Co. of Michigan, Los Angeles.

Treasurer—Henry W. Howell, Pres., Howell Foundry Co., Los Nietos.

Directors—Terms Expire 1949

A. L. Goodreau, Pres., G-B Brass & Aluminum Foundry, Inc., Los Angeles.
C. E. Holmer, Fdry Frm., Sorbomat Process Engineers, Inc., Huntington Park.
Arthur B. Lamb, Chamberlain Co., Los Angeles.
Myron B. Niesley, Pres., California Testing Laboratories, Inc., Los Angeles.
Henry E. Russill, Eld Metal Co., Ltd., Los Angeles.

Directors—Terms Expire 1950

Robert C. Coulson, Fdry. Supt., Kaiser Co., Inc., Iron & Steel Div., Fontana.
Donald A. Eggleston, Ace Foundry Co., Ltd., Huntington Park.
James H. DeWald, Partner, Bell Foundry Co., South Gate.
John J. Derkin, Frm., Los Angeles Steel Casting Co., Ltd., Los Angeles.

Tennessee Chapter

Chairman—G. Frank Anderson, V.P. & G.M., Chattanooga Implement & Mfg. Co., Chattanooga.

Vice-Chairman—K. L. Landgrebe, Supt. Fdry. Div., The Wheland Co., Chattanooga.

Secretary-Treasurer—Herman Bohr, Jr., Partner, Robbins & Bohr, Chattanooga.

Directors—Terms Expire 1949

Lester Bealer, Supt., American Brake Shoe Co., Chattanooga.
Ormand C. Corry, V.P., Harrison-Corry Co., Knoxville.
Carter N. Paden, V.P. & G.M., Moccasin Bushing Co., Chattanooga.
Paul H. Stuff, Met., Ross-Meehan Foundries, Chattanooga.

Directors—Terms Expire 1950

W. C. Cate, Chief Chem., Crane Co., Chattanooga Div., Chattanooga.
W. P. Delaney, Pres., Eureka Fdry. Co., Chattanooga.

Directors—Terms Expire 1951

P. L. Arnold, Res. Mgr., U. S. Pipe & Fdry. Co., Chattanooga.
Charles Saunders, Tennessee Products & Chemical Corp., Nashville.

Texas Chapter

Chairman—Jake Dee, Owner, Dee Brass Foundry, Houston.

Vice-Chairman—C. W. Williamson, V.P., Trinity Valley Iron &

Steel Co., Ft. Worth.
Secretary—P. B. Croom, Mgr., Houston Pattern Works, Houston.
Treasurer—E. W. Wey, Ass't. Mgr., Dee Brass Foundry, Houston.
Directors—Terms Expire 1949
George E. Bryant, Jr., Pres., Oil City Brass Works, Inc., Beaumont.
L. N. Crim, East Texas Electric Steel Co., Longview.
R. H. Glenney, Ass't. Chief Engr., Alamo Iron Works, San Antonio.
DeWitt McKinley, Mgr., McKinley Iron Works, Fort Worth.
Directors—Terms Expire 1950
Chas. R. McGrail, Pres., Texaloy Foundry Co., San Antonio.
H. L. Roberts, V.P., Oil City Iron Works, Corsicana.
Joseph A. Wolf, Wolf Pattern Works, Houston.
E. P. Clarke, Dist. Sales Repr., American Wheelabrator & Equipment Corp., Houston.
Directors—Terms Expire 1951
M. J. Henley, Met., Texas Foundries, Inc., Lufkin.
F. G. Huber, Pres. & Gen. Mgr., Able Supply Company, Inc., Houston.
Thurman Killman, Gen. Supt., Texas Steel Co., Ft. Worth.
W. H. Lyne, Res. Engr., Hughes Tool Company, Houston.

Timberline Chapter

Chairman—J. L. Higson, Partner, Western Foundry, Denver.
Vice-Chairman—Shelby C. Cooke, Sr., Secy.-Treas., U. S. Foundries, Inc., Denver.
Secretary—John W. Horner, Jr., Slack-Horner Brass Mfg. Co., Denver.
Treasurer—Alvin O. Gruenwald, Ass't. Sec'y., Manufacturers' Foundry Corp., Denver.
Directors—Terms Expire 1950
E. B. McPherson, Pres., McPherson Corp., Denver.
Pearson M. Payne, Mgr., Rotary Steel Castings Co., Denver.
C. O. Penney, C. S. Card Iron Works Co., Denver.
Edward B. Zabriskie, Plant Mgr., Magnus Metals Division, National Lead Co., Denver.
Directors—Terms Expire 1951
William E. Norris, American Manganese Steel Division, Denver.
A. H. Patten, Patten Engineering Co., Denver.
Arthur L. Schneider, Owner, Western Bronze & Brass Foundry, Denver.
James W. Silver, Pres., Ogden Iron Works Co., Ogden, Utah.

Toledo Chapter

Chairman—Emmett E. Thompson, Pattern Supt., Unitcast Corp.
Vice-Chairman—Harry G. Schwab, Chf. Met., Bunting Brass & Bronze Co.
Secretary-Treasurer—R. C. Van Hellen, Prod. Mgr., Unitcast Corp.
Directors—Terms Expire 1949
A. V. Fromm, Supt., American Brake Shoe Co.
N. P. Mahoney, Supt., Maumee Malleable Castings Co.
Otto H. Schmidt, Pattern Shop Supt., National Supply Co.
Directors—Terms Expire 1950
Bernard J. Beierla, Met., E. W. Bliss Co., Toledo Machine & Tool Co. Div.
Frank W. Beierla, Pres., Clinton Pattern Works.
Brock L. Pickett, Chf. Insp., Unitcast Corp.
Directors—Terms Expire 1951
John G. Blake, Supt., Alloy Founders, Inc.
Gerald R. Rusk, Sales Rep., Freeman Supply Co., Perrysburg.
Robert H. Zoller, Gen. Mgr., Zoller Casting Co., Bettsville.

Tri-State Chapter

Chairman—Dale Hall, Met., Oklahoma Steel Castings Co., Tulsa.
Vice-Chairman—C. A. McNamara, Jr., Sec'y.-Treas., Big Four Foundry Co., Inc., Tulsa, Okla.
Secretary—D. A. Mitchell, Slsmn., Progressive Brass Mfg. Co., Tulsa, Okla.
Treasurer—R. H. Timberlake, Slsmn., Metal Goods Corp., Tulsa.
Directors—Terms Expire 1949
Fred E. Fogg, Sls. Engr., Acme Foundry & Machine Co., Coffeyville, Kans.
Morris C. Helander, Plant Mgr., Empire Pattern & Foundry Co., Tulsa, Okla.
R. W. Trimble, Fdry. Supt., Bethlehem Supply Co., Tulsa.
Directors—Terms Expire 1950
B. P. Glover, Slsmn., M. A. Bell Co., Tulsa, Okla.
Frank R. Westwood, Sr., Owner, Service Foundry, Inc., Wichita, Kans.
Directors—Terms Expire 1951
C. C. Beagle, Fdry. Supt., The Webb Corp., Webb City, Mo.
J. E. Winger, Sec'y.-Treas., Tulsa Iron Works Co., Tulsa, Okla.

Twin City Chapter

Chairman—Carleton C. Hitchcock, V.P., R. C. Hitchcock & Sons, Minneapolis.
Vice-Chairman—Franklin A. Austin, Vice-Pres., Crown Iron Works, Minneapolis.
Secretary-Treasurer—Lillian K. Polzin, Director, Manufacturers' Secretariat, Minneapolis Chamber of Commerce.
Directors—Terms Expire 1949
S. L. Cameron, Jr., Vice-Pres., Valley Iron Works, Inc., St. Paul, Minn.
E. R. Frost, Pres., The E. R. Frost Co., Minneapolis.
Sheldon P. Pufahl, Pres., Pufahl Fdry., Inc., Minneapolis.
Robert C. Wood, Vice-Pres., Minneapolis Electric Steel Castings Co., Minneapolis.
Directors—Terms Expire 1950
Clarence J. Becker, V.P., & Treas., Union Brass & Metal Mfg. Co., St. Paul.
Charles Kausel, Secy-Treas., Kausel Foundry Co., Minneapolis.
Francis J. Marrin, Pres., Marrin Foundry, Inc., Minneapolis.
Directors—Terms Expire 1951
Joseph W. Costello, Patt. Shop Frm., American Hoist & Derrick Co., St. Paul.
Carl W. Olson, Jr., Fdry. Mgr., C. W. Olson Manufacturing Co., Minneapolis.
C. Fred Quest, V.P., J. F. Quest Foundry Co., Minneapolis.

Washington Chapter

Chairman—George E. Rauen, Met. Supt., Olympic Steel Works, Seattle.
Vice-Chairman—Edward D. Boyle, Master Molder, Puget Sound Naval Shipyard, Bremerton.
Secretary—Fred R. Young, Sls. Engr., E. A. Wilcox Co., Seattle.
Treasurer—Russell Wetherell, Pur. Agt., Olympic Foundry Co., Seattle.
Directors—Terms Expire 1949
Chas. M. Anderson, V.P., Eagle Brass Foundry Co., Seattle.
James D. Tracy, Treas., Salmon Bay Foundry Co., Inc., Seattle.
Directors—Terms Expire 1950
S. Fick, Supt., Fick Foundry, Tacoma.
Frank H. Jefferson, Slsmn., Carl F. Miller Co., Seattle.
Barton E. Sather, Owner, Sather Foundry Co., Everett.
Denny Vena, Mgr., American Foundry Co., Seattle.
Edward J. McAfee, Master Patternmaker, Puget Sound Naval Shipyard, Bremerton.

Western Michigan Chapter

Chairman—W. A. Hallberg, Fdry. Engr., Lakey Foundry & Machine Co., Inc., Muskegon.
Vice-Chairman—C. H. Jacobson, Prod. Mgr., Dake Engine Co., Grand Haven.
Secretary—Stanley H. Davis, Sand Res. & X-Ray Engr., Campbell, Wyant & Cannon Foundry Co., Muskegon.
Treasurer—Paul Babcock, Challenge Machinery Co., Grand Haven.
Directors—Terms Expire 1949
Otto H. Frank, Qual. Res. Engr., Muskegon Piston Ring Co., Sparta.
Fred H. Papke, Fdry. Supt. Wolverine Brass Works, Grand Rapids.
William Grant, V.P., Paul M. Wiener Fdry. Co., Muskegon.
Directors—Terms Expire 1950
Harold BeMent, Chf. Met., Campbell, Wyant & Cannon Foundry Co., Muskegon.
Robert DeVore, Supv. Meltg., Lakey Foundry & Machine Co., Inc., Muskegon.
Victor Pyle, Pyle Pattern & Mfg. Co., Muskegon Heights.
Directors—Terms Expire 1951
Roy H. Herbst, West Michigan Steel Foundry Co., Muskegon.

C. H. Lloyd, Engr., E. F. Houghton & Co., Grand Rapids.
W. R. Tuthill, Supt., Iron Div., American Seating Co., Grand Rapids.

Western New York Chapter

Chairman—Martin J. O'Brien, Jr., Ass't. Wks. Mgr., Symington Gould Corp., Depew.
Vice-Chairman—John R. Wark, Sales Dept., Queen City Sand & Supply Co., Buffalo.
Secretary—Roger E. Walsh, Sales Repr., Hickman, Williams & Co., Inc., Buffalo.
Treasurer—Martin W. Pohlman, V.P., Pohlman Foundry Co., Inc., Buffalo.
Directors—Terms Expire 1949
Alfred A. Diebold, Works Mgr., Atlas Steel Castings Co., Buffalo.
John C. Nagy, Chf. Chem., Chas. C. Kawin Co., Buffalo.
Leo C. Smith, Pres., Lakeside Bronze, Inc., Buffalo.
Fred L. Weaver, Weaver Material Service, Buffalo.
Directors—Terms Expire 1950
Leonard Greenfield, Plant Mgr., Samuel Greenfield Co., Buffalo.
Carl A. Harmon, Chf. Met., Hanna Furnace Corp., Buffalo.
Edw. J. Roesch, Supt., American Brake Shoe Co., Buffalo.
Directors—Terms Expire 1951
Walter Hunsicker, Fdry. Supt., Worthington Pump & Machinery Corp., Buffalo.
George A. Knowles, Owner, Geo. A. Knowles Foundry, Inc., Niagara Falls.
Henry F. Sproull, Dist. Repr., A. P. Green Firebrick Co., Buffalo.

Wisconsin Chapter

President—R. C. Woodward, Chief Met., Bucyrus-Erie Co., Milwaukee.
Vice-President—Arthur C. Haack, Wauwatosa.
Secretary—Walter W. Edens, Tech. Dir., Badger Brass & Aluminum Foundry Co., Milwaukee.
Treasurer—George E. Tisdale, Sec'y.-Treas., Zenith Foundry Co., West Allis.
Directors—Terms Expire 1949
C. M. Lewis, Sec'y.-Treas., Badger Malleable & Mfg. Co., South Milwaukee.
Arthur K. Higgins, Met., Allis-Chalmers Mfg. Co., Milwaukee.
Directors—Terms Expire 1950
Walter W. Edens, Tech. Dir., Badger Brass & Aluminum Foundry Co., Milwaukee.
A. F. Pfeiffer, Pattern & Foundry Div., Allis-Chalmers Mfg. Co., Milwaukee.
J. G. Risney, Owner, Risney Foundry Equipment Co., Milwaukee.
Directors—Terms Expire 1951
R. J. Anderson, Wks. Mgr., Belle City Malleable Iron Co., Racine.
S. E. Mueller, Fdry. Res. Engr., Falk Corp., Milwaukee.
J. V. Olle, Met., Motor Castings Co., West Allis.

STUDENT CHAPTERS

University of Illinois

Chairman—Charles E. Drury
Vice Chairman—Harold French
Treasurer—Joseph M. David
Secretary—Robert W. Bales

Missouri School of Mines and Metallurgy

Chairman—John W. Mitchell
Vice-Chairman—Richard M. Frazier
Secretary—Martin Leo Slawsky
Program Chairman—James E. Reynolds, Jr.

Ohio State University

Chairman—Thomas S. Dole
Vice-Chairman—Harold J. Gonya

University of Minnesota—*Election to be held.*

Oregon State College—*Election to be held.*

Massachusetts Institute of Technology—*Election to be held.*

World's Largest X-Ray Development Laboratory Dedicated At Milwaukee

NAMED IN HONOR of Dr. William D. Coolidge, the "father of the modern x-ray tube," General Electric X-Ray Corporation's new engineering laboratory was dedicated at Milwaukee, Wis., September 13. Ceremonies were attended by many distinguished visitors, including the nation's leading radiologists, physicists, military experts, and research scientists.

Speakers at the dedication ceremonies for the new laboratory, the largest of its kind in the world, included, in addition to Dr. Coolidge, President Charles E. Wilson of the General Electric Corp., Dr. Arthur C. Christie, professor of radiology at Georgetown University Medical School, and the following officials of the General Electric X-Ray Corp.: J. H. Clough, president; J. H. Smith, executive vice president; M. J. Gross, vice president in charge of engineering; and W. D. Crelley, merchandising manager.

A major product announced at the ceremony as forthcoming in the near future is an x-ray diffraction apparatus which will open up broad new fields of application for diffraction in research and industry. One attachment, the fluorescent analyzer, is expected to extend greatly the range of composition of materials which can be analyzed by diffraction. The new diffraction unit couples, for the first time, precision control of x-ray output with high x-ray intensity.

Bureau Of Standards Establishes New Automotive Testing Laboratory

AUTOMOTIVE ENGINE PERFORMANCE under closely simulated actual operating conditions is now being studied at a newly-opened laboratory at the National Bureau of Standards, Washington, D. C., under the direction of A. R. Pierce. Equipped with completely automatic controls, the laboratory is designed primarily for investigating cylinder wear, but can be used to study the effects of various types of fuels and lubricating oils on pistons, piston rings, bearings, and carburetors. A problem currently under investigation is the determination of the amount of sulphur that can be tolerated in gasolines without appreciably increasing wear.

Cylinder wear, an important factor limiting the useful life of automotive engines, is difficult to determine except by actual operation of a test engine under conditions of frequent starting, stopping, accelerating, and cooling, such as occur in normal driving. Road testing has not proved satisfactory in this work because of the impossibility of controlling operating conditions.

The automatic test equipment utilizes a battery of five automotive engines from three popular makes of automobiles. Each engine is complete except for fans, radiators and mufflers, and is coupled to a dynamometer. By varying the electrical output of the dynamometer and by regulating the throttle opening, any speed within the range of the engine may be obtained. The extent of cylinder wear is determined by a McKee wear gauge.

The engines, under the control of a master clock, are put through an operating cycle which provides conditions corresponding to cold starting, warm-up, speed-up, idling, stopping, and cooling, on a half-hour cycle.

New AFS MEMBERS

Period August 15 - September 15: Four conversions to sustaining membership and four to company membership occurred during this period and one new company member was added. Total new members during the period was 113 with 30 chapters showing gains. Leading chapters were Tennessee, 13, Saginaw Valley, 11, and Ontario, 9.

Company to Sustaining

Cureton Castings Co., Mt. Vernon, Ohio—Sam Cureton (Central Ohio Chapter).
Royall Fire Brick & Supply Co., Houston—John H. Royall, Mgr. (Texas Chapter).
Unitcast Corp., Industrial Steel Casting Div., Toledo—Joseph L. Tillman, Vice-Pres. (Toledo Chapter).
U. S. Reduction Co., East Chicago, Ind.—E. A. Bergman (Chicago Chapter).

Personal to Company

Hines Flask Co., Cleveland—R. J. Hines, Vice-Pres. & Mgr. (Northeastern Ohio Chapter).
Luria Bros. & Co., Cleveland—Jack Levand, Ohio Dist. Mgr., (Northeastern Ohio Chapter).
Stainless Foundry & Engineering Co., Milwaukee—John K. McBroom (Wisconsin Chapter).
Wysong & Miles Co., Greensboro, N.C.—Orville C. Hoover, Fdry. Supt. (Non-Chapter).

NEW COMPANY MEMBERS

R. H. Siskin & Sons Inc., Chattanooga—Garrison Siskin, Pres. (Tennessee Chapter).

BIRMINGHAM DISTRICT CHAPTER

Edmund C. Kain, Jr., Engr., Attalla Pipe & Foundry Co., Attalla, Ala.
Oscar N. McKinley, Frm., Central Foundry Co., Holt, Ala.
George F. Morris, Supt., Eagle Stove Works, Rome, Ga.
Sam G. Reid, Chemist, Attalla Pipe & Foundry Co., Attalla, Ala.

BRITISH COLUMBIA CHAPTER

Fred Bay, 1842 Broadway, W. Vancouver, B.C.
J. Christie, Appr., Terminal City Iron Works, Ltd., Vancouver, B.C.
Ronald Lynch, Appr., Associated Foundry Ltd., Burnaby, B.C.
Arthur C. Soul, Associated Foundry Ltd., Burnaby, B.C.

CENTRAL ILLINOIS CHAPTER

John W. Demmler, Secy., William Demmler & Bros. Co., Kewanee, Ill.

CENTRAL INDIANA CHAPTER

Leslie R. King, Asst. Planning Supv., Perfect Circle Corp., New Castle, Ind.
Ralph W. Stahl, Lindberg Engineering Co., Indianapolis.

CENTRAL MICHIGAN CHAPTER

Allen T. Sanders, Patt. Maint. Frm., Albion Malleable Iron Co., Albion, Mich.
Palmer Sheppard, Supv. Core Dept., Albion Malleable Iron Co., Albion, Mich.

CENTRAL NEW YORK CHAPTER

John J. Hurd, Frm., Meloon Bronze Foundry Inc., Syracuse, N.Y.

CENTRAL OHIO CHAPTER

G. W. Gilchrist, Asst. Fdry. Supt., Cooper-Bessemer Corp., Mt. Vernon, Ohio.
Don Penry, Asst. Supt., Alloy Cast Steel Co., Marion, Ohio.
John R. Walley, Supv. Standards, The Ohio Steel Foundry Co., Dayton, Ohio.
Keith Welch, Engr., Alloy Cast Steel Co., Marion, Ohio.

CHESAPEAKE CHAPTER

Louis L. Caperon, Molder, Gibson & Kirk Co., Baltimore, Md.
Jerry Paxton, Molder, Gibson & Kirk Co., Baltimore, Md.

CHICAGO CHAPTER

John E. Bossong, Res. Met., American Steel Foundries, East Chicago, Ind.
Bjorn Polfelt, Engr., Arrow Pattern & Foundry Co., Chicago.

* Company Member

CINCINNATI DISTRICT CHAPTER

William Knox Conley, Frm., The Bardes Forge & Foundry Co., Cincinnati.
Melvin N. Schmidt, Sales Repr., Sterling Wheelbarrow Co., West Allis, Wis.

DETROIT CHAPTER

Don Bechler, Dist. Mgr., Syntron Co., Detroit.
E. R. Laine, Supv. of Stds., Penberthy Injector Co., Detroit.

E. CANADA & NEWFOUNDLAND CHAPTER

Marc Melanson, Vice-Pres., Melanson's Foundry Ltd., Montreal, Que.
Harold Robert MacInnis, Dominion Engineering Works, Montreal, Que.

EASTERN NEW YORK CHAPTER

Charles Hewlett Ackley, Appr. Molder, General Electric Co., Schenectady, N.Y.
James W. Burch, Appr. Molder, General Electric Co., Schenectady, N.Y.
John G. Holmes, Engr., General Electric Co., Schenectady, N.Y.
Vincent J. Monini, Steel Melter, General Electric Co., Schenectady, N.Y.
Walter Teppo, Jr., Appr. Molder, General Electric Co., Schenectady, N.Y.
H. LaSalle Wheatley, Sand Check & Control, General Electric Co., Schenectady, N.Y.
Henry J. Wirenski, Steel Melter, General Electric Co., Schenectady, N.Y.

METROPOLITAN CHAPTER

Robert D. Bailey, Time Study & Methods Engr., Worthington Pump & Machinery Corp., Harrison, N.J.
C. William Holmes, Smith Oil & Refining Co., Fair Lawn, N.J.
W. F. Meredith, Field Engr., Ttianium Alloy Mfg. Co., New York, N.Y.

MICHIANA CHAPTER

Robert R. Ashley, Supt., Josam Products Foundry Co., Michigan City, Ind.
Kent B. Wonnell, Engr., Peru Foundry Co., Peru, Ind.

NORTHEASTERN OHIO CHAPTER

M. D. Bensley, Salesman, Cleveland Flux Co., Cleveland.

NORTHERN CALIFORNIA CHAPTER

Bill Burt, Frm., Berkeley Brass Foundry Co., Berkeley, Calif.

NO. ILLINOIS & SO. WISCONSIN CHAPTER

Edward Gaessel, Gen. Mold. Frm., Beloit Iron Works, Beloit, Wis.

NORTHWESTERN PENNSYLVANIA CHAPTER

Henry Breter, Patt. Shop Frm., Bucyrus-Erie Co., Erie, Pa.
Robert A. Erskine, Met., National Erie Corp., Erie, Pa.
Edger D. Hill, Fdry. Frm., Griswold Mfg. Co., Erie, Pa.
William J. Holmes, Frm., Griswold Mfg. Co., Erie, Pa.
Paul T. Kennedy, Ind'l. Engr., Griswold Mfg. Co., Erie, Pa.
R. C. Strong, Fdry. Frm., Griswold Mfg. Co., Erie, Pa.
Frank Warner, Fdry. Frm., Griswold Mfg. Co., Erie, Pa.

ONTARIO CHAPTER

E. John Barbeau, Fdry. Mgr., McKinnon Industries, Ltd., St. Catharines, Ont.
Alvin E. Bock, Mgr., A. E. Bock Foundry Co., Galt, Ont.
F. L. Fetes, Fdry. Supt., Anthes-Imperial Ltd., St. Catharines, Ont.
Jerry J. Dillon, Fdry. Supt., Galt Malleable Iron Co., Ltd., Galt, Ont.
W. L. Henderson, Fdry. Gen. Frm., Anthes-Imperial Ltd., St. Catharines, Ont.
Cecil Maddick, Gen. Supt., Massey-Harris Co., Brantford, Ont.
John McRoberts, Mgr., Hamilton Match Plate Co., Hamilton, Ont.
Tadeusz Miksza, Fdry. Appr., The McKinnon Industries Ltd., St. Catherines, Ont.
James D. Wilde, Salesman, Webster & Sons Ltd., Toronto, Ont.

QUAD CITY CHAPTER

Robert Ernest Miller, Fdry. Engr., John Deere Planter Works, Moline, Ill.

SAGINAW VALLEY CHAPTER

Floyd P. Boardman, General Motors Corp., Central Foundry Div., Saginaw, Mich.
James B. Brown, Personnel Dir., General Motors Corp., Saginaw Malleable Iron Plant, Saginaw, Mich.
Norman V. Crabtree, Abr. Engr., Norton Co., Lansing, Mich.
Guy M. Dwdewicz, Co-op. Student, General Motors Institute Tech., Saginaw.
David T. Martin, Insp. Dept., General Motors Corp., Saginaw Malleable Iron Plant, Saginaw, Mich.

William A. McCarthy, Supv. of Stds. & Methods, General Motors Corp., Central Foundry Div., Saginaw, Mich.
George Meyer, Core Room Supt., General Motors Corp., Central Foundry Div., Saginaw, Mich.
R. Verne Righter, Personnel Dir., General Motors Corp., Saginaw Malleable Foundry, Saginaw, Mich.
Thomas C. Schnell, Prod. Mgr., General Motors Corp., Central Foundry Div., Saginaw, Mich.
Theodore Schroeder, Fdry. Supt., General Motors Corp., Central Foundry Div., Saginaw.
Leon F. Watson, Gen. Frm., General Motors Corp., Chevrolet Grey Iron Foundry, Saginaw, Mich.

SOUTHERN CALIFORNIA CHAPTER

Felix L. Dauriac, Fdry. Supt., National Brass Works, Inc., Los Angeles, Calif.
Robert O. Holmes, Owner, Dependable Pattern Works, Inc., Los Angeles, Calif.
Robert L. Kay, Asst. to Fdry. Supt., Kay-Brunner Steel Products, Inc., Alhambra, Calif.
Joemac Murphy, Coreroom Frm., Magnesium Alloy Products Co., South Gate, Calif.
William E. Quinn, Cleaning Dept. Frm., Axelson Mfg. Co., Los Angeles, Calif.
Robert W. Wagner, Gen. Mgr., National Brass Works, Inc., Los Angeles, Calif.

TENNESSEE CHAPTER

*R. H. Siskin & Sons, Inc., Chattanooga, Tenn. (Garrison Siskin, Pres.)
Harold D. Carey, Purch. Agt., Ross-Meehan Foundries, Chattanooga.
Fred B. Eiseman, Insp., Ross-Meehan Foundries, Chattanooga.
J. R. Elbergeld, Crane Co., Chattanooga.
Clayton R. Genung, Asst. Met., Ross-Meehan Foundries, Chattanooga.
H. P. Jernigan, Jr., Salesman, Mills & Lufston Supply Co., Chattanooga.
Robert A. Nixon, Salesman, Nixon Machinery & Supply Co., Inc., Chattanooga.
James L. Payne, Sales Dept., Ross-Meehan Foundries, Chattanooga.
Romley W. Ragland, Draftsman, Combustion Engineering Co., Chattanooga.
A. Mose Siskin, Vice-Pres. & Treas., R. H. Siskin & Sons, Inc., Chattanooga.
Ernest L. Smith, Stand. Dept., Ross-Meehan Foundries, Chattanooga.
C. L. Tribble, Coreroom Frm., Ross-Meehan Foundries, Chattanooga.
Robert B. Young, Engr., Combustion Engineering Co., Chattanooga.

TEXAS CHAPTER

Charles L. Slover, Asst. Met., Texas Foundries, Inc., Lufkin.

TWIN CITY CHAPTER

Homer F. Anderson, Frm., Patt. Shop., Electric Machinery Mfg. Co., Minneapolis.

WASHINGTON CHAPTER

Donald M. Williams, Sales, Campbell Hardware & Supply Co., Seattle.

WESTERN MICHIGAN CHAPTER

Karl Betz, Pres. & Treas., Betz Foundry, Inc., Grand Rapids, Mich.
Wilson Hicks, Fdry. Met., Sealed Power Corp., Muskegon, Mich.
R. W. Ransom, Prod. Mgr., Standard Foundry Inc., Cadillac, Mich.
Kenneth S. Witt, Works Mgr., Sealed Power Corp., Muskegon, Mich.

WISCONSIN CHAPTER

Adrian Archambault, Fdry. Instr., Wisconsin Vocational School, Manitowoc, Wis.

STUDENT CHAPTERS

OREGON STATE COLLEGE

Harold Leonard Hermanson

OUTSIDE OF CHAPTER

Simon Feigenbaum, Res. Engr., Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Thomas F. Pepe, Asst. Works Mgr., The Hartford Electric Corp., Branford, Conn.
Durson D. Utku, Lt. Cmdr., Turkish Navy, Portsmouth, Va.

Argentina

Cesar Borja, Met. Engr., Industrias Quimicas Argentinas "Duperial" Edificio Duperial-Paseo Colon 285, Buenos Aires.
Mario O. A. Piccinini, Lt. Eng. Argentine Navy, Buenos Aires.
Jorge F. D. Plater, Teniente decFragata Ingeniero, Buenos Aires.

Belgium

Andre Germay, Admin. Delegue, Les Allïages Legers "A.L.S.A.," Wettern.

China

C. H. Chou, Res. Lab., Ministry of Communications, Nanking.

England

H. Sunderland, Stoneleigh, Southlands Mount, Riddlesden Keighley.

France

Georges Daugenet, Tech. Dir., Fonderie des Ardennes, Pont Audemer, Eure.

Portugal

Manuel Margues Gomes Filho, Rua do Rosario 5-10, Porte.

South Africa

Herbert George William Pillman, Mng. Dir., Safanco Ltd., Johannesburg.

Spain

Luis Marques Maristany, Ind. Engr., Fundiciones Industriales, S.A., Barcelona.

Switzerland

Walter Meier, Chem. Engr., Sulzer Bros. Ltd., Winterthur.

Joint Industry-Military Mobilization Guide Issued By U. S. Munitions Board

INDUSTRIAL MOBILIZATION in the event of war will be greatly simplified and will avoid the costly mistakes of World War II if the precepts outlined in The Munitions Board's *Military Procurement—A Guide for Joint Industry-Military Procurement Planning* are followed. The purpose of the Guide is to help industrial management to plan now for mobilization in the event of war.

"If plant managers give attention NOW to conversion problems covered by the checklist of questions in the Guide," the booklet states, "—mobilization time will be greatly reduced, sources of confusion will be removed and the military procurement job will be more efficient in the event of any future emergency. To the plant manager, this will mean that his company has improved its chance of survival in a total war . . . and to the plant manager as a citizen, it will mean that the chance of survival of his Country in time of total emergency is strengthened"

The Guide stresses such questions as: "Was your plant operating at capacity during World War II?", "Were your products those best suited to your facilities and abilities?", "Did you have trouble in obtaining and holding adequate and properly skilled manpower?" and "Should the occasion arise again, what would you want to do differently?"

The Guide is not a form. It does not have to be filled out and returned. It is designed to focus attention to the problems of military procurement planning.

The document has six sections. Section I describes how industry is mobilized in time of war—what the industrialist does and what the Government does, the basic assumptions on which planning is based, and what the problem of industrial mobilization amounts to. Section II is a checklist to measure preparedness for industrial mobilization. Section III describes the current program for allocation of industrial capacity to the Armed Services. Section IV lists strategic and critical materials and multipurpose components in short supply in World War II. Section V lists the procurement offices of the three Military departments. Section VI lists the military offices now engaged in purchasing operations.

"Six years have passed since the conversion boom of World War II," the Guide states, "Time may have obscured the confusions and uncertainties of that period—the pressing need of the War Production Board for information about private industry. Many early mistakes and blind alleys might have been avoided had courses of action been decided on the basis of fact rather than theory."

Copies of the Guide are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C. Price: 25 cents.

Detroit Chapter Publishes Directory

A DIRECTORY OF MEMBERSHIP of the Detroit Chapter of the American Foundrymen's Society for 1948-49 has recently been published by the Chapter. Comprising 56 pages, the Directory lists names and addresses of both company and individual members, together with officers, directors, honorary life members, and sustaining members. The Directory is cross-indexed by company affiliation, and contains the Chapter by-laws.

CHAPTER ACTIVITIES NEWS

Tennessee Chapter

Carl A. Fischer, Jr.
Equipment & Supply Company
Chapter Reporter

THE FIRST ANNUAL BARBECUE of the Tennessee Chapter was held on Saturday, August 28, at the Signal Mountain Golf and Country Club; starting at one o'clock and ending at seven o'clock. There were many guests from out of town; Clifford B. Cornell, secretary and treasurer of the Cleveland Flux Co., flying from Cleveland, and Sidney S. Keywood, sales engineer of Harnischfeger Corp., flying from New Orleans.

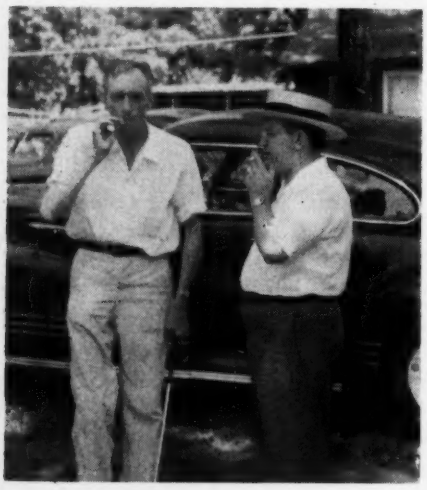
General chairman of the outing was Karl Landgrebe of Wheland Co., co-chairman was Paul Arnold of U. S. Pipe and Foundry Co. The committee had Lee Brown, who has had many years experience, barbecue the meats.

Guests entertained themselves by playing golf, pitching horseshoes, swimming, bingo, and an unusual baseball game played by using darts and a target board. The Chattanooga team defeated the Birmingham team. Milton Marks, plant engineer of Crane Co., was umpire.

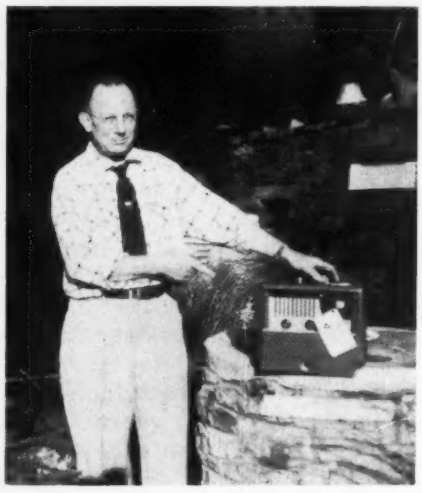
Twelve useful and valuable gifts were given as attendance prizes.

Pictures of the occasion were taken by Frank Robbins of the Ross-Meehan Foundry Company and Paul Arnold of the U. S. Pipe and Foundry Company.

The Tennessee Chapter held its first meeting of the fall and winter season September 17th, at the Hotel Patten. G. Frank Anderson, vice-president and general manager of the Chattanooga Implement and Mfg. Co. and Karl Landgrebe, production foundry superintendent of the Wheland Co., chairman and vice-chairman of the chapter, presided at this meeting of nearly 100 foundrymen and their guests.



Howard Barker (left), superintendent, U. S. Pipe & Foundry Co., and G. Frank Anderson, Chattanooga Implement & Mfg. Co., chapter chairman, snapped during an informal moment at the Tennessee Chapter's 1st Annual Barbecue at Signal Mountain Golf and Country Club, Chattanooga, August 28.



Earl Strick, Erie Malleable Iron Co., lucky winner of the grand prize at Northwestern Pennsylvania Chapter's 3rd Annual Picnic, poses with the prize, a portable radio.

Guest speaker for the evening was W. B. McFerrin of Detroit, district manager and director of research for the Electro Metallurgical Co. His subject was "Casting Defects." Mr. McFerrin is one of the outstanding authorities in the country on casting defects and is at present serving as vice-chairman of the Analysis of Casting Defects Committee of American Foundrymen's Association.

The lecture, which was illustrated with slides, completely covered the various types of casting defects, their causes, and how such defects could be remedied. At the conclusion of the lecture, Mr. McFerrin participated in a question and answer session, highlighted by his discussion of the term "carbon equivalent."

This horseshoe pitching foursome at Central Michigan Chapter's August 21 outing are, left to right, Al Twining, American Marsh Pump Co.; Ray Jenny, Kellogg Co.; Ira Brandenburg, American Marsh Pump Co.; and Harry McCool, of the American Marsh Pump Co.

Northeastern Ohio

R. H. Herrmann
Penton Publishing Co.
Chapter Reporter

THE OPENING MEETING of the 1948-49 season, held September 9 at the Cleveland Club, brought out 235 members and guests for a Clambake Dinner and subsequent technical sessions. The meeting was presided over by Chapter President Walter E. Sicha, Aluminum Co. of America, who recently succeeded to that office when former Chapter President Elmer C. Zirzow joined Deere & Co., Moline, Ill. William E. Gude of the Penton Publishing Co. has been named to succeed Mr. Sicha as chapter vice-president.

At the separate technical sessions

of the foundry and patternmaking groups, the former was addressed by L. P. Robinson, Werner G. Smith Co., Cleveland, on "Cutting Costs in the Coreroom." Mr. Robinson pointed out that it is possible to make a core with any kind of sand, but not necessarily a good core, consequently, selection of the correct sand grade is a primary consideration. The wrong sand can mean excessive use of binder, as evidenced by one foundry, which saved about $8,000 a year in the coreroom by changing from a cheap bank sand to a relatively-expensive, clay-free sand.

Lack of intelligent help in preparing core sand mixtures and use of poor measuring devices can also prove costly. Other sources of waste are excessive use of cereal binders and failure to adopt the correct mixing time in preparing core sand. The speaker indicated that inefficient baking operations cause more trouble than other factors, difficulties being caused either by baking at the wrong temperature or use of ovens having poor heat distribution, or both.

Carl Winkler, Cleveland Standard Pattern Works, was chairman and discussion leader for the patternmakers' session, which included three talks. Al Fath, Jr., P.M.S. Co., Cleveland, described various patternmaking equipment and supplies, including matchplates, a special cutting tool and a new cold water-proof glue. E. T. Kindt, Kindt-Collins Co., Cleveland, gave a brief demonstration on how to apply coatings to wood patterns. The main part of his talk was devoted to a discussion of pattern lumber. Pine wood for patterns is scarce and the supply is not likely to improve, he said. Mr. Kindt showed samples of South American woods which have been experimented with to determine their suitability as pattern stock. Cost of these woods was said to be close to that of domestic lumber.

The concluding presentation was a description by Normal Maples, Wellman Products Co., Cleveland, of the company's corebox machine, and a demonstration of its operation by the inventor, O. L. Miller.

A few of the foundrymen who attended the Tennessee Chapter's First Annual Barbecue, held at the Signal Mountain Golf & Country Club, Aug. 28.

Northwestern Pennsylvania

James J. Farina
American Sterilizer Co.
Chapter Reporter

THE THIRD ANNUAL PICNIC and Golf Tournament was held Saturday, September 11 at the Lake Shore Golf Club, Erie, and at Tieman's Grove.

A picnic patterned after those of yesteryear included a continuous buffet lunch and refreshments, with such contests as egg-throwing, watermelon rolling and horseshoes.

The grand prize, a portable radio, was won by Earl Strick, Erie Malleable Iron Co.

The committee in charge of the Picnic consisted of F. Carlson, Weil-McLain Co.; W. Bartles, Erie Mal-

A few of the hundreds of foundrymen who attended Central Ohio Chapter's Annual Picnic and Outing, held at the Columbus Riding Club, August 21, and featuring sports, games, dinner and entertainment.

Trying their luck in the casting weight guessing contest at the Central Michigan Chapter's Outing at the Cascades Club, Jackson, August 21 are, left to right, Howard C. and Harold E. Bennett of Capitol Castings Co., Lansing, and Michael Novosell, Albion Malleable Iron Co., Albion, Mich.

leable Iron Co.; R. Carver, Standard Stoker Co.; S. Stroup, Peerless Mineral Products; C. Wilcox, Cascade Foundry Co.; H. Lolley, Bucyrus Erie Co.; F. Volgstadt, Griswold Mfg. Co.; and J. Farina, American Sterilizer Co.

Ontario Chapter

Alvin E. Bock
A. E. Bock Foundry Co.
Chapter Reporter

THE ANNUAL PICNIC was held at Barnesdale, the estate of Ralph Barnes of Wm. R. Barnes & Co.—an ideal location for a function of this kind. The Chapter is deeply appreciative of Mr. Barnes' generosity. Golfers teed off at the Dundas Golf Course at 10 a.m. At Barnesdale, the afternoon was spent in contests, such as darts, egg-throwing, horseshoes, shooting and other recreational activities. After a plentiful and sumptuous buffet supper door prizes were awarded. It was a full, enjoyable afternoon spent in renewing old acquaintances. First prize winners in the contests were: Shooting—John Wotherspoon. Egg Throwing—John Puchy and Robert Germond. Horseshoes — Ralph Barnes and Ernest Snowden. Darts —R. Beckett. Golf—N. Nesbitt, H. W. Watson.

No. Illinois-So. Wisconsin

Upton Bartlett
Alloy Castings Co.
Technical Secretary

NINETY MEMBERS AND GUESTS attended the September meeting held at the Faust Hotel, Rockford, Ill., September 14. Officers for the current season were introduced, they are: Chairman H. J. Bauman, Smith Oil Co.; Vice-chairman, L. C. Fill, George D. Roper Corp.; Secretary, F. W. Thayer, Gunite Foundries Corp.; and Treasurer, C. L. Dahlquist, Greenlee Bros & Co. Mr. Fill presided at the meeting.

After the showing of a motion picture on "Mechanized Cupola Charging," Ford R. Snyder, metallurgist, Hickman, Williams & Co., spoke on "Control of Cupola Operation." Mr. Snyder emphasized the value of simple control in overcoming difficulties arising from uncertain qualities of pig iron, scrap and coke, as well as in attaining maximum economies. Following Mr. Snyder's address, Roy Baysinger, Iron Star Foundry, presided over a question and answer session.

Central Michigan

Fitz Coghlin, Jr.
Albion Malleable Iron Co.
Vice-Chairman

MORE THAN 200 FOUNDRYMEN attended the Chapter's outing at the Cascades Club, Jackson, August 21. Although it was one of the hottest days of the year, the temperature failed to quell the merriment that took place throughout the full day of sports, eating and entertainment. The daytime activities included horseshoes, bait and fly casting, golf and other sporting events. Sandwiches and refreshments were served throughout the day.

A group of Albion Malleable Iron Co. softball players gave a good account of themselves in a game with Engineering Castings Co.'s team. Although no official figures were obtainable, it is said that the Albion team won by a 20-5 score. Prizes were awarded winning contestants in all sporting events.

In the evening, the group with-

Trying for a ringer in a horseshoe pitching contest at Michiana Chapter's Annual Stag Outing, September 11.

Play Ball! A Michiana Chapter member gets all set for a lusty clout at the ball during the Chapter's Stag Outing at Tabor Farm, Sodus, Mich.

drew to the clubhouse for a big, all-you-can-eat fried chicken dinner. Entertainment, including four acts of vaudeville, brought a fitting conclusion to an excellent outing.

Outing Chairman Jack Secor, Hill & Griffith Co., and his committee are to be congratulated upon their efforts. Committee members are: W. E. Hunt, Industrial Metal Abrasives Co.; J. M. Crowley, Pioneer Foundry Co.; E. Doerschler and R. A. Miller, U. S. Foundry Corp.; C. W. Dock, Dock Foundry Co.; H. O. McCool, American Marsh Pumps, Inc.; M. Novosel, Albion Malleable Iron Co., N. Dumas, Trojan Casting Co.; C. C. Sigerfoos, Michigan State College; E. Zeuch, John Bean Co.; C. Fike, Hardie Mfg. Co.; A. Stone, Albion Malleable Iron Co.; K. Loer and R. Hatfield, Engineering Castings, Inc.; K. Beulow and L. Dobson, Marshall Furnace Co.; F. Coghlin, Jr., L. Calicotte, and J. Bommarito, Albion Malleable Iron Co.

Central Ohio

H. W. Lownie, Jr.
Battelle Memorial Institute
Chapter Reporter

THE ANNUAL PICNIC AND OUTING of the Central Ohio Chapter, held at the Columbus Riding Club, August 21, was attended by more than 275 members and their guests. The afternoon was devoted to games and sports, including a baseball game, horseshoe pitching and darts.

The ham dinner was followed by distribution of more than a hundred door prizes contributed by friends of the chapter. The day's activities were topped off with an excellent program of professional entertainment.

The success of the outing was due primarily to the efforts of the Picnic Committee under the chairmanship of E. M. Durstine, Keener Sand & Clay Co., and Committee Members William Huffman, Buckeye Iron & Brass Works; Fred Fuller, National Engineering Co.; Walter Deutsch, Columbus Malleable Iron Co.; D. E. Krause, Gray Iron Research Institute; R. A. Willey, Commercial Steel Castings Co.; Gray Lummis, A. P. Green Firebrick Co.; and Howard Morgan of the Cedar Heights Clay & Coal Co.

Central New York

John A. Feola
Crouse-Hinds Co.
Publicity Chairman

THE CHAPTER'S 1948-49 SEASON opened September 10 with a Clam Bake held at the Three Rivers Inn and attended by 80 members and their guests. The outing started at 3:00 p.m., with dinner at 6:30. No business or technical sessions were held, in keeping with Chapter policy of holding its first meeting as an informal get-together to promote good fellowship, and to give members a chance to get better acquainted with each other.

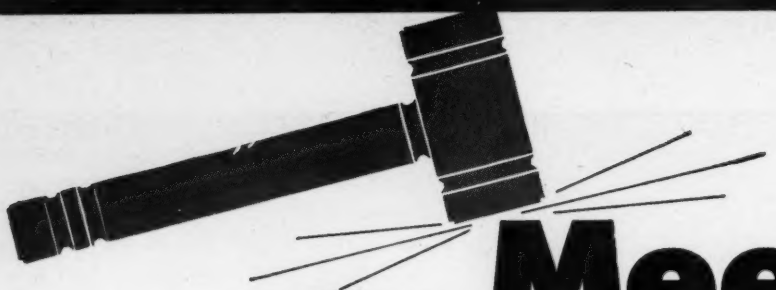
Southern California

Robert C. Smith
Jenkins Publications, Inc.
Chapter Reporter

"DEVELOPMENT OF the Metal Castings Industry" was the subject of an address by A.F.S National Director Bruce L. Simpson, speaking before the September meeting of the Chapter at Rodger Young Auditorium, Los Angeles. Mr.

(Continued on Page 85)

It's the eighteenth hole for this foursome at the Annual Spring Golf Tournament of the Oregon Chapter at City View Golf and Country Club, Portland, June 19. The acrobatic handshake at the right may be either purely congratulatory, a secret fraternal grip or a mild form of jiu-jitsu.



Chapter Meetings

OCTOBER 15
TEXAS
Texas State Hotel, Houston
J. H. RICKEY, JR.
Ironton Fire Brick Co.
"Recent Developments in Foundry Refractories"

OCTOBER 18
QUAD CITY
Fort Armstrong Hotel, Rock Island, Ill.
W. M. OWEN
Caterpillar Tractor Co.
"Apprentice Training"

OCTOBER 19
CENTRAL MICHIGAN
American Legion Club, Battle Creek
L. L. CLARK
Buick Motor Co.
"Cupola Operation"

BRITISH COLUMBIA
Medical-Dental Auditorium, Vancouver
CLYDE A. SANDERS
American Colloid Co.
"Foundry Sands"

OCTOBER 20
MISSOURI SCHOOL OF MINES & METALLURGY
Experimental Station, Rolla, Mo.
Motion Picture: "Foundry Horizons"
Discussion lead by Dr. D. S. Eppelsheimer, Faculty Advisor
"The Microstructure of Gray Cast Iron"

OCTOBER 22
UNIVERSITY OF ILLINOIS
Foundry Bldg., University Campus, Urbana
INSTALLATION OF STUDENT CHAPTER

CHESAPEAKE
Engineers' Club, Baltimore
WILLIAM H. JOHNSON
Naval Research Laboratory
"Gating Systems for Castings"

WASHINGTON
Gowman Hotel, Seattle
CLYDE SANDERS
American Colloid Co.
"Foundry Sands"

OCTOBER 25
TIMBERLINE
Oxford Hotel, Denver
S. C. MASSARI
A.F.S. Technical Director
"Present Day Raw Materials and Their Melting"

NORTHWESTERN PENNSYLVANIA
Moose Club, Erie
WILLIAM H. OWEN
Harbison-Walker Refractories Co.
"Refractories in the Foundry"

OCTOBER 29
ONTARIO
Royal York Hotel, Toronto
GROUP MEETINGS

NOVEMBER 1
CENTRAL ILLINOIS
Jefferson Hotel, Peoria
W. M. BALL
R. Lavin & Sons, Inc.
"Non-Ferrous Foundry Practice"

METROPOLITAN
Essex House, Newark, N.J.
C. K. DONOHO
American Cast Iron Pipe Co.
"Acid Electric Steel Castings"

NOVEMBER 4
TWIN CITY
American Hoist & Derrick Co., St. Paul
(Joint Meeting with North West Chapter, American Society for Metals)
CHARLES LOCKE
Armour Research Foundation
"Foundry Practice"

SAGINAW VALLEY
Fischer's Hotel, Frankenmuth, Mich.
Round Table
"Gating and Risering"

NOVEMBER 4-5
CENTRAL INDIANA
MICHIANA
Purdue University
Lafayette, Ind.
METALS CASTING CONFERENCE

NOVEMBER 5
CENTRAL NEW YORK
Onandaga Hotel, Syracuse
ROUND TABLE MEETING

SOUTHERN CALIFORNIA
Rodger Young Auditorium, Los Angeles
W. W. LEVI
Lynchburg Foundry Co.
"Carbon Control in the Cupola"

NOVEMBER 8
CENTRAL OHIO
Chittenden Hotel
Group Meeting—Two Sections
"Gray Iron—Steel"

NOVEMBER 10
TRI-STATE
Joplin, Mo.
Speaker to be announced.

NOVEMBER 11
NORTHEASTERN OHIO
Cleveland Club, Cleveland
FORD SNYDER
Hickman-Williams & Co.
"Controls in Cupola Operations"

NOVEMBER 12
PHILADELPHIA
Engineers' Club, Philadelphia
A. W. GREGG
Whiting Corp.
"Comparison of Electric Furnace and Cupola Melting of Cast Iron"

STATEMENT OF OWNERSHIP

Statement of the ownership, management, circulation, etc., required by the acts of Congress of August 24, 1912, March 3, 1933, and July 2, 1946, of AMERICAN FOUNDRYMAN, American Foundrymen's Association, published monthly at Chicago, Ill., for October 1, 1948, State of Illinois, County of Cook, ss. Before me, a notary public in and for the state and county aforesaid, personally appeared Herbert F. Scobie, who, having been duly sworn according to law, deposes and says that he is the Editor of the AMERICAN FOUNDRYMAN, American Foundrymen's Society, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, and July 2, 1946, embodied in section 537, Postal Laws and Regulations, to-wit: 1—That the names and addresses of the publisher, editor, managing editor, and business managers, are: Publisher, American Foundrymen's Society, Inc., Chicago, Ill.; Editor, Herbert F. Scobie, Chicago, Ill.; Managing Editor, None; Business Managers, None. 2—That the owner is American Foundrymen's Society, Inc., not for profit; stock, none. Principal Officers: W. B. Wallis, President, Pittsburgh Lectromelt Furnace Co., Pittsburgh, Pa.; E. W. Horlebein, President, Gibson & Kirk Co., Baltimore, Md.; Wm. H. Maloney, Secretary-Treasurer, Chicago, Ill. 3—That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None. 4—That the two paragraphs next above, giving the names of the owners, stockholders, and the security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholder's and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. Herbert F. Scobie, editor. Sworn to and subscribed before me this 1st day of October, 1948. (Seal). C. L. Reilly, notary public. (My commission expires March, 1952).

FOUNDRY Personalities

A. Cristello, formerly manager of Eclipse-Pioneer Foundries of Bendix Aviation Corp., and a prominent figure in nonferrous founding for the last 20 years, has joined American Light Alloys, Inc., Little Falls, N.J., as executive vice-president.

Sherrill S. Deputy, assistant sales manager of American Wheelabrator & Equipment Corp., Mishawaka, Ind., since 1946, was recently appointed sales manager. Prior to his association with American Wheelabrator, Mr. Deputy spent 18 years with International Business Machines, Inc., in sales and administrative positions.

Dr. D. P. Morgan, who recently joined Mathieson Chemical Corp. as administrator of research and development, has been appointed vice-president in charge of the Development department. Before coming to Mathieson, Dr. Morgan was in charge of chemical market research and development at W. R. Grace & Co. During World War II, he served as director of the Chemicals bureau of the War Production Board. Dr. Morgan is a graduate of Harvard University and received his Ph.D. in chemistry from Columbia University.

William H. Starbuck has been appointed assistant general sales manager of the Kellogg Division of the American Brake Shoe Co. A graduate of Yale University, Mr. Starbuck was formerly sales representative for Brake Shoe. He will be located at Division headquarters in Rochester, N.Y.

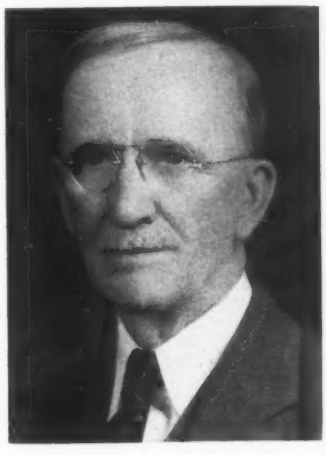
M. E. Brooks, formerly foundry engineer with the Bay City Division of the Dow Chemical Co., Midland, Mich., has

M. E. Brooks

accepted an executive engineering position with Magnesium Alloy Products Co., Compton, Calif., and will act as advisor on technical details of magnesium foundry operation. Author of a number of papers published by A.F.S., Mr. Brooks is vice-chairman of the A.F.S. Aluminum & Magnesium Division and a member of the A.F.S. Technical Correlation Committee.

R. T. Hain, formerly manager of the Bond plant of the American Radiator & Standard Sanitary Corp., Buffalo, has accepted the position of vice-president and general manager in charge of manufacturing of the National Radiator Co., Johnstown, Pa. An employee of American Radiator for 21 years, Hr. Hain was manager of the Bond plant for 17 years.

Frank Webster Brady, since 1902 a member of the faculty of International Correspondence Schools, retired recently as director of the School of Shop Practice. He

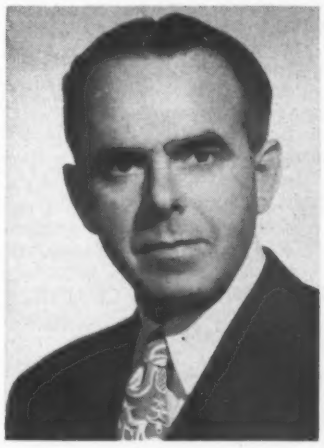


F. W. Brady

is 86 years old. Mr. Brady graduated from Purdue University in 1888 with a degree in mechanical engineering, and was for a time professor of engineering at the Purdue Shops, and later on the faculties of New Mexico State College, Pennsylvania State College Extension, and city and railroad YMCA's. He worked as an engineer on power plants, hydro-mining plants, electric railways, church construction, and telephone system planning. Since joining ICS, Mr. Brady has written scores of textbooks which have been a great contribution to the nation's educational and industrial progress.

G. A. Watson has been appointed to succeed **J. H. Spillane** as manager of sales for the Chicago Division of Electro Metallurgical Sales Corp. Mr. Spillane has been transferred to the General Sales Office in New York. Mr. Watson had previously served in various sales and service capacities in both the Chicago and Detroit offices of the company, which is a unit of Union Carbide & Carbon Corp.

John Bing, Wisconsin sales manager for the A. P. Green Firebrick Co. for 17 years,



John Bing

recently resigned to become general manager of Metropolitan Refractories Corp., New York City, distributors for A. P. Green and other refractories products. Active in many A.F.S. affairs, Mr. Bing was president of the Wisconsin Chapter in 1945-46.

Howard G. Pankratz has been appointed industrial engineer for the R. C. Mahon Co., Detroit. Mr. Pankratz formerly served as consulting engineer on industrial equipment to the company.

Emmett Torkelson became foundry superintendent at the Louis Meskan Brass Foundry, Inc., Chicago, in August. He replaced Henry De Quaker who was drowned while vacationing in Wisconsin. Mr .Torkelson was formerly a partner in the Able Foundry and was a foreman at Howard Foundry for three years.

Dr. A. B. Parsons, for 18 years secretary of the American Institute of Mining and Metallurgical Engineers, has announced his resignation effective February, 1949. In the meantime, Dr. Parsons will be on leave of absence. During Dr. Parsons' administration, the number of professional divisions of the AIME increased from four to seven, the number of local sections from 26 to 44, and the membership from 7,800 to 18,750. Dr. Parsons presented his resignation at a meeting of the executive and finance committees on July 23, was urged to reconsider his decision, but restated it a month later.

Dr. Carl F. Prutton, formerly head of the department of chemistry and chemical engineering at Case Institute of Technology, has joined Mathieson Chemical Corp. as director of research. Dr. Prutton was a faculty member at Case from the

A.F.S. CHAPTER DIRECTORY

BIRMINGHAM DISTRICT CHAPTER
Secretary-Treasurer, F. K. Brown, Adams, Rowe & Norman, Inc.
BRITISH COLUMBIA CHAPTER
Secretary-Treasurer, L. P. Young, A-1 Steel & Iron Foundry Ltd.
CANTON DISTRICT CHAPTER
Secretary, Robt. L. Fasig, Ashland Malleable Iron Co.
CENTRAL ILLINOIS CHAPTER
Secretary-Treasurer, Vern M. Swango, Caterpilla Tractor Co.
CENTRAL INDIANA CHAPTER
Secretary, Jack Giddens, International Harvester Co.
CENTRAL MICHIGAN CHAPTER
Secretary-Treasurer, George Petredean, Calhoun Foundry Co.
CENTRAL NEW YORK CHAPTER
Secretary, David Dudgeon, Jr., Utica Radiator Co.
CENTRAL OHIO CHAPTER
Secretary, D. E. Krause, Gray Iron Research Institute.
CHESAPEAKE CHAPTER
Secretary-Treasurer, C. A. Robeck, Gibson & Kirk Co.
CHICAGO CHAPTER
Secretary, V. M. Rowell, Velsicol Corp.
CINCINNATI DISTRICT CHAPTER
Secretary, B. A. Genthe, S. Obermayer Co.
DETROIT CHAPTER
Secretary, J. N. Phelps, Vanadium Corp. of America.
EASTERN CANADA AND NEWFOUNDLAND CHAPTER
Secretary, J. G Hunt, Dominion Engineering Works Ltd.
EASTERN NEW YORK CHAPTER
Secretary Treasurer, Ugo Navarette, General Electric Co.
METROPOLITAN CHAPTER
Secretary, J. F. Bauer, Hickman, Williams & Co.
MEXICO CITY CHAPTER
Secretary, N. S. Covacevich, La Consolidada S.A.
MICHIANA CHAPTER
Secretary-Treasurer, V. S. Spears, American Wheelabrator & Equip. Co.
NORTHEASTERN OHIO CHAPTER
Secretary, R. D. Walter, Werner G. Smith Co.
NORTHERN CALIFORNIA CHAPTER
Secretary, Charles R. Marshall, Chamberlain Co.
NORTHERN ILLINOIS-SOUTHERN WISCONSIN
Secretary, F. W. Thayer, Gunite Foundries Corp.
NORTHWESTERN PENNSYLVANIA CHAPTER
Secretary, Reginald Harding, Pickands-Mather Co.
ONTARIO CHAPTER
Secretary-Treasurer, G. L. White, Westman Publications Ltd.
OREGON CHAPTER
Secretary Treasurer, Geo. C. Vann, Northwest Fdry. & Fce. Co.
PHILADELPHIA CHAPTER
Secretary-Treasurer, W. B. Coleman, W. B. Coleman & Co.
QUAD CITY CHAPTER
Secretary-Treasurer, C. R. Marthens, Marthens Co.
ROCHESTER CHAPTER
Secretary-Treasurer, L. C. Kimpal, Rochester Gas & Electric Corp.
SAGINAW VALLEY CHAPTER
Secretary-Treasurer, Raymond H. Klawuhn, General Fdry. & Mfg. Co.
ST. LOUIS DISTRICT CHAPTER
Secretary, P. E. Retzlaff, Busch-Sulzer Bros.-Diesel Engrg. Co.
SOUTHERN CALIFORNIA CHAPTER
Secretary, J. E. Wilson, Climax Molybdenum Co.

39

TENNESSEE CHAPTER
Secretary-Treasurer, Herman Bohr, Jr., Robbins & Bohr.
TEXAS CHAPTER
Secretary-Treasurer, P. B. Croom, Houston Pattern Works
TIMBERLINE CHAPTER
Secretary, John W. Horner, Jr., Slack-Horner Brass Mfg. Co.
TOLEDO CHAPTER
Secretary-Treasurer, R. H. Van Hellen, Unitcast Corp.
TRI-STATE CHAPTER
Secretary, D. A. Mitchell, Progressive Brass Mfg. Co.
TWIN CITY CHAPTER
Secretary-Treasurer, L. K. Polzin, Minneapolis Chamber of Commerce.
WASHINGTON CHAPTER
Secretary-Treasurer, Fred R. Young, E. A. Wilcox Co.
WESTERN MICHIGAN CHAPTER
Secretary, S. H. Davis, Campbell, Wyant & Cannon Fdry.
WESTERN NEW YORK CHAPTER
Secretary, R. E. Walsh, Hickman, Williams & Co.
WISCONSIN CHAPTER
Secretary, W. W. Edens, Badger Brass & Aluminum Fdry. Co.

STUDENT CHAPTERS

UNIVERSITY OF MINNESOTA *Secretary*, Harvey Sauby
MISSOURI SCHOOL OF MINES *Secretary*, Martin L. Slawsky
OHIO STATE UNIVERSITY *Secretary-Treasurer*, Eldon Boner
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Secretary-Treasurer, Martin J. O'Brien
OREGON STATE COLLEGE *Secretary*, John P. Meece
UNIVERSITY OF ILLINOIS *Secretary*, Robert W. Bales

6

time of his graduation from that school in 1920 until 1948, and served as a consultant to the Lubrizol Corp. from 1928 to 1948, and as consultant to the Dow Chemical Co. from 1928 to 1941. From 1942 to 1944, Dr. Prutton served as chief of the Process Development branch of the Office of Rubber Director, and as a consultant to the War Production Board.

Harry H. Reich of Trussville, Ala., has been appointed sales representative in its Southern territory for the Shanafelt Mfg. Co., Canton, Ohio.

Robert J. Powell has been appointed refractory sales engineer for the Alabama, Tennessee, Western Georgia and Florida territory of The Babcock & Wilcox Co. Mr. Powell, a native of Georgia, received his engineering education at the Georgia Institute of Technology, and has had some 15 years' experience in the production and sale of B & W refractories.

Sigmund Simond, who has served Superior Foundry, Inc., Cleveland, for 54 years, retired recently. The Company's oldest employee, Mr. Simond started at the age of 15 as an office boy, and has since served as time clerk, pattern clerk, payroll clerk, Eastern representative, and, at the time of his retirement, sales representative for the Company's line of finished piano plates.

Robert J. Stein, assistant secretary and assistant treasurer of Acme Aluminum Alloys, Inc., Dayton, Ohio, has been appointed sales representative for the company's Michigan territory. He will make his headquarters in Detroit.

Prof. Gregory J. Comstock, incumbent of the nation's only chair of powder metallurgy, at Stevens Institute of Technology, Hoboken, N.J., is being retained by the Lake Erie Engineering Corp., Buffalo, as consultant on powder metallurgy and its applications. Widely-known for his research work in the field, Prof. Comstock has served as technical consultant to the Government on powder metallurgy. In addition to his capacity as consultant with Lake Erie Engineering Corp., he will conduct extended research and development work for the company in powder metallurgy as applied to hydraulic press design.

Victor L. Persbacker, appointed auditor of the American Brake Shoe Co. at a recent Board of Directors meeting, will continue, in addition to his new duties, to serve as assistant comptroller of the company. Mr. Persbacker first joined Brake Shoe in 1934 and was appointed assistant comptroller in 1945.

W. B. Landers has been appointed Southwest Texas sales representative for the Baker Industrial Truck Division of the Baker-Raulang Co., Cleveland, Ohio. He will be located at 702 M & M Bldg., Houston. Simultaneously, the company announced the appointment of **Fred R. Ramsen,** 2120 S. Seventh St., St. Louis, as

(Continued on Page 86)

FOUNDRY Literature

Readers interested in obtaining additional information on items described in Foundry Literature should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.

Dial Scale Applications

OT101—Six three-color technical bulletins, containing data, diagrams, and practical application information on dial scales, are offered gratis to production and traffic managers by Yale & Towne Mfg. Co. The first brochure is devoted to counting scales, the second and third to bench and portable platform scales, the fourth to dormant platform scales, the fifth to crane scales, and the last to weigh-can installations. The six bulletins are attractively bound in an illustrated folder.

Blast Cleaning Guide

OT102—A valuable guide to the solution of many production problems in blast cleaning is the Pangborn Corp.'s 24-page illustrated booklet. The list of contents covers such items as cabinets, tables, barrels, rooms, special machines, dust collectors, fans, wetters, etc., together with information and performance data on each type of machine. A three-way index is a handy guide to the proper equipment to be used for each purpose.

Magnetic Separators

OT103—An eight-page, two-color catalog describing the complete line of Eriez Mfg. Co.'s permanent non-electric, magnetic separators is now available. Complete specifications regarding weights, sizes and strength comparisons for various types of plate magnets are given, as well as tables of operating capacities for permanent magnetic drums, pulleys, pneumatic line assemblies and pipeline traps. All types of magnetic equipment are fully illustrated by photographs and engineering drawings. Engineering services and laboratory facilities are also discussed.

Laboratory Equipment

OT104—The latest issue of Eberbach & Son Co.'s *Announcer* features an article on the development of chemical porcelain by C. S. Ryland, Coors Porcelain Co., from prehistoric times to the present. In addition, descriptions and specifications are listed for several Eberbach products—Buchner funnels, the Larabee Tiltrater, the Deoxo gas purifier, the Hohwald specific gravity chain balance, power supplies, the Coleman Universal Spectrometer, Glascol flask heaters, Chromalox hot plates, a stopwatch and companion stopwatchman, the Junior AC Centrifuge and Emson rubber tubing. Prices are listed on each item.

Technical Organ

OT105—Readers of AMERICAN FOUNDRYMAN are advised that they will be placed upon the mailing list of the quarterly-issued *Lavingot*, technical house organ of R. Lavin & Sons, Inc., upon request. The *Lavingot* carries timely technical articles and newsworthy foundry information in each issue. Subscriptions are free.

Steel Mill Lithograph

OT106—Public understanding of the production of steel—how it's done—has been furthered through the publication of a graphic full-color page advertisement in

the *Saturday Evening Post* of September 25. Entitled "How a Steel Mill Operates," the presentation features a natural-color cut-away view of a typical steel mill. The accompanying explanation takes the reader behind the scenes to see the progressive steps in the production of steel—from iron ore to finished steel. Full-color 21x22 in. enlargements of the cutaway view, suitable for framing, are offered free of charge. These enlargements should be of particular value to educational institutions and to public relations personnel who are often called upon to explain how steel is made. Armstrong Cork Co. is the sponsoring company.

Night-Gang

OT107—Beardsley & Piper's new Junior Nite-Gang is described in a folder recently issued by the company. The Nite-Gang can be easily moved to any floor in the foundry, plugged in, loaded with sand. The Nite-Gang then elevates the sand, discharges it over the magnetic separator. Sand then drops into the Screenarator, which screens, aerates and discharges sand at rates up to 20 tons per hour, anywhere within a radius of 25 ft and 160 degrees into heap, windrow or container.

Industrial Electric Motors

OT108—Just released by the Lima Electric Motor Co., Bulletin MB-1 describes the Lima line of electric motors, multi-speed gearshift drives, pedestal grinders and polishing and buffing lathes. This bulletin is of particular interest to original equipment manufacturers and users.

FOUNDRY FILMS

OT109—*"Precision Investment Casting"* is the title of a new 16-mm sound motion picture in full color, produced by the Allis-Chalmers Mfg. Co., and portraying the various steps involved in this process. Scenes are taken in the company's new precision foundry. Here each production step, from the manufacture of a wax injection die to the final cleaning of the castings and their inspection is covered. The final scenes of the film picture dozens of different castings produced at the Allis-Chalmers Foundry, including intricate cams and levers for industrial sewing machines, stainless steel ports for food processing machines, blades for steam turbines, gas turbines and superchargers. Running time for the film is about 12 minutes. Prints are available for showing free of charge to interested organizations.

Cutter Bit Grinding

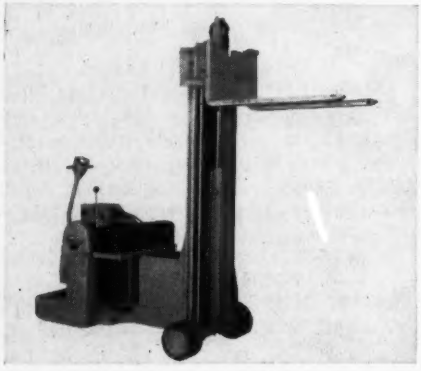
OT110—A new 16-mm colored sound film, *"Grinding and Use of Basic Lathe Tool Cutter Bits"* is announced by the South Bend Lathe Works. The film shows steps in grinding and use of cutter bits for such lathe operations as threading, facing, boring, forming, turning, cutting-off, etc. Film is distributed on a free-loan basis and is available for outright purchase. The film has been professionally produced in full color under the direction of expert machinists and experienced educators to provide an effective and accurate medium. Cutting tools and steps in their use are described in detail. This film is recommended for foreman and supervisor training and for the instruction of apprentice machinists and lathe operators. Other films previously released in this series are *"The Lathe"* and *"Plain Turning."*

NEW Foundry Products

Readers interested in obtaining additional information on items described in New Foundry Products should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.

Transtacker

OT1—A suspended fork model Transtacker costing five per cent less and weighing 17 per cent less and incorporating 10 major improvements over its predecessor models, is announced by the Automatic



Transportation Co. New features include: automatic tilt at carrying position; adjustable tilt height provides for handling of materials from tinplate pallets to 12-in. skid platforms; non-skid drive tires; higher road clearance; hydraulic release lever and pushbutton controls; stronger construction and higher capacity.

Laboratory Furnaces

OT2—Boder Scientific Co., announces a new line of laboratory furnaces, including a pilot size unit for melting ferrous or nonferrous metals in 10 lb lots for laboratory tests; a high speed, high-temperature, automatically controlled box furnace with work chamber 12 x 6 x 4¾ in.; a small gas tight laboratory unit for metallurgical evaluations at elevated temperatures in various atmospheres; muffle furnaces with working chambers of small dimensions up to 24 x 15 x 12 in.; and a wide variety of sizes of tube furnaces.

Magnetic Sweeper

OT3—A new magnetic sweeper, the Magna Sweep, developed by the Dings Magnetic Separator Co., consists of a permanent plate magnet mounted on wheels for pushing over floor or ground to pick up iron and steel particles. The machine can be used for keeping foundry gangways clean from spills, and for reclaiming ferrous scrap, and is capable of picking up 10 to 20 lbs of turnings or 40 lbs of plate in one load. In operating position, the magnet rests on a horizontal non-magnetic wearing plate to which the iron and steel is attracted and firmly held. To clean, the operator lifts the lever on the handle and the magnet is raised up and away from the wearing plate, allowing the iron to drop off. Available in two sizes—Size A, based on a 12 in. magnet, and Size B, based on a 24-in. magnet. Bulletin B 1906A is available upon request.

Roto-Filter

OT4—Designed to provide analytical laboratories with a compact rotating filtering unit that will save time, energy and space, the Precision Mfg. Co.'s new Roto-Filter can be effectively used in plant control work in the metals industries. The

Roto-Filter is constructed like the "Lazy Susan" used on old-fashioned dinner tables and holds beakers and funnels which are revolved until the desired one is in front of the analyst. Base of the unit is fitted with drain and a continuous flow of fresh water. Shelves may be raised or lowered to accommodate various sizes of funnels or other vessels in which filtrate is retained. Requires table space only 22 x 22 in. square. Thermostatically-controlled hot plate to be mounted on top of Roto-Filter for keeping solution in the bottle hot is optional. Base is of cast aluminum construction. Shelves are of Prestwood.

Analyslips

OT5—A method of breaking down any list of items without rewriting and placing each item on a separate piece of paper has been developed for Ditto machines. A set of overlapped strips, called "Analyslips", are run through the Ditto machine, then torn apart and used as desired. Analyslips can be used in such applications as inventry control, inspection unit copies and sales analyses.

Pyrometer Controller

OT6—The development of a proportional current-input electronic pyrometer controller is announced by the Bristol Co. The instrument proportions the current-input to electrically-heated ovens, furnaces, plastic molding machines, salt pots and similar equipment to provide practically straight-line temperature control by means of time modulation of input energy. The average energy supplied is proportionate to the deviation of the temperature from the control point throughout a band width, adjustable from 0 to 2½ per cent of full scale reading. Bulletin PB 1237 is available.

Analytical Balance

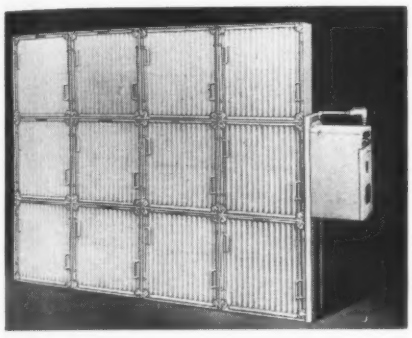
OT7—A distinct innovation in direct-reading analytical balances, Fisher Scientific Co.'s Gram-Atic Balance has but one pan. All weighings are made under constant load, and weight handling is entirely

eliminated. Widely used in European laboratories, this Swiss-made instrument is capable of making weighings in one-third of the time required by ordinary analytical balances. In operation, load on the beam is always brought to 200 grams by removing weights equal to that of the sample. Weights are indicated on the direct-reading scale as they are removed and the uniform loading produces a constant sensitivity regardless of the weight of the sample and enables the final beam deflection to be transposed to milligrams. A feature which facilitates fast weighing is

rapid weight manipulation by means of control knobs on front panel. No weights are handled manually. As weights up to 0.01 gram are removed, corresponding figures appear on direct reading scales. Weight less than 0.01 gram is indicated optically on illustrated screen. Enclosed in sturdy aluminum case.

Electronic Air Filter

OT8—An electronic air filter, the Electro-PL, developed by the American Air Filter Co., has an intermediate cleaning efficiency for applications where the efficiency of a



mechanical filter is too low and that of an electronic precipitator too high. The new filter is basically an electronic precipitator without an ionizing unit and contains a collector element of electrostatically charged porous cellulose paper. When charge is applied to the paper, plies tend to separate and each fibre becomes a collecting electrode. Electro-PL will operate when de-energized, and can thus be used as an electronic air cleaner during winter months, and as a dry-type air filter during the summer. Further details are described in Bulletin 257.

Diamond Penetrators

OT9—Two improved diamond penetrators for Rockwell testing are announced by Clark Instrument, Inc. Model "C" fits all makes of hardness testers for standard Rockwell testing. Model "S" fits all machines for superficial Rockwell testing. Diamond points are specially designed for proper stratification and freedom from stresses. Holders are expertly designed and finished to precisely correct angles and radii. Furnished as a standard accessory for all Clark Hardness Testers.

Blast Gun

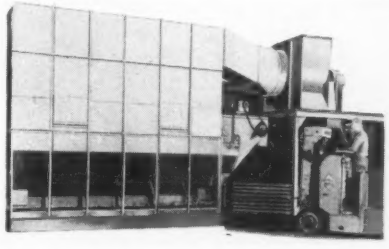
OT10—Engineered Products, Inc.'s Tornado Combination Blast Gun is a versatile adaptation of sand blasting and solvent spraying, and improves and simplifies surfacing, production, cleaning and finishing. Air-operated and portable, the Tornado leaves no buffing marks, grooves or ridges, or scuffed, gouged or uneven surfaces. There are no shafts to break, wheels to dress or motors to burn out. Particularly useful in reaching inaccessible places, this blast gun can be connected to any air line and is equipped for sand blast operations or for spraying solvents and liquids. Two attachments are furnished with gun—a case-hardened nozzle for blasting, and a nozzle for use with oils or chemicals. Abrading nozzle has a safety tip that drops off when barrel needs replacement. Gun is equipped with three-pint container. Maximum air consumption is 9½ cfm at 100 to 150 lb pressure. Weight: 4½ lb.

Welding Rods

OT11—Tube Tungsite and Tungrod, two new tungsten carbide welding rods for reclamation and hard-surfacing applications, are announced by the American Manganese Steel Division of the American Brake Shoe Co., Tube Tungsite consists of tungsten carbide particles of various screen sizes encased in a steel tube. When applied as a welding rod, the steel tube melts easily, forming a molten matrix. The particles have an extremely high melting point, thus do not melt but remain in suspension. Rapid solidification then occurs and evenly distributes particles in the welding deposit, forming a highly wear-resistant surface. Tungrod differs from Tube Tungsite in that Tungrod particles are from 40 screening down, whereas Tube Tungsite particles range from 5 to 40 screen size. Tungrod is applied in two types—bars for oxyacetylene applications, and coated, for electric applications. Brochure describing these products in greater detail is available.

Centri-Merge Arrester

OT12—A new 30,000 cfm Centri-Merge Swirl Type Arrester is announced by Schmeig Industries, Inc. The all stainless



steel construction guarantees longer, corrosion-free operations, with a minimum of long-range mantenance costs. The unit is used to remove dust and dirt from shake-out stations, sand handling and conditioning systems. Sludge disposal is by a skid on a lift truck. Conveyor drive is on top of conveyor spout. Compact design assures minimum floor space requirements.

X-Ray Diffraction Unit

OT13—A research X-ray diffraction unit, the HRX, is announced by Hilger & Watts, Ltd., London, England. Designed to provide the fullest possible facilities for X-ray diffraction work in either the research department or the works laboratory, the HRX is fool-proof, press-button operated and completely self-contained. The HRX consists of a demountable hot-cathode X-ray tube, provided with four windows, mounted upon a steel cabinet whose top is the camera table which accommodates four adjustable camera bars. Inside cabinet are the vacuum pumps, exciting transformers, and other apparatus. Unit requires connection to water supply and single phase a-c mains. Voltages from 150 to 250 at 50 cycles.

Flexible Flask

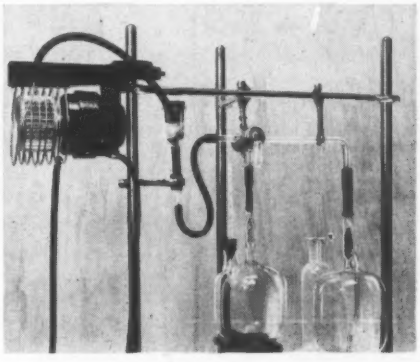
OT14—An all-aluminum flexible flask whose copes and drags fit together in innumerable combinations to accommodate a wide variety of sizes and molds has been developed by the C. S. Humphrey Co. Ends and sides are standard in dimension and fully interchangeable. Ends are available in widths 12 to 36 in.; sides in lengths 12 to 36 in.; heights of copes and drags 3 to 7 in. Ends and sides increase by 2 in. multiples; height of ends and sides by 1 in. multiples. Easy to assemble or disassemble using a common wrench.

Vertical Grinders

OT15—The Buckeye Tools Corp. announces that its line of vertical air grinders has been completely redesigned and streamlined, using magnesium castings for strength and lightness. The Stream-Power grinders feature internal-blade units, with full-floating, equalizing rotor mounted on a one-piece shaft suspended on two labyrinth-sealed ball bearings. Built-in oil reservoir insures proper lubrication of all moving parts. Replaceable heli-coil inserts in castings provide steel-to-steel engagements of bolts to castings. Straight-line air flow through handle delivers plentiful air supply to motor. Available speeds: 3100, 4000, 4500, 5500 and 6000 rpm.

Gas Cooler

OT16—A gas cooler for carbon determinators developed by the Harry W. Dietert Co. utilizes a blower fan connected to an electric motor to cool incoming gas as it passes through small diameter stainless steel tubing. With this arrangement, the incoming gases are brought to the same temperature as that at which the



volume measuring parts of the carbon determinator operate, thus making greater accuracy in carbon determination possible.

Rollover and Draw Machine

OT17—Designed for operation when a jarring machine or sand slinger is operated separately from a rollover machine, a special rollover and draw machine developed by the Herman Pneumatic Machine Co. is available throughout the entire range of rollover machines from 750 lbs capacity up to and including 40,000 lbs capacity at 80 lbs air pressure. Features include special fabricated turnover plate, charging and discharging conveyor, automatic pattern clamps, automatic chain type flask or core plate clamps and direct-acting vibrator.

HIGHEST STANDARDS

in composition, size and weight

. . . THAT'S KEOKUK ELECTRO-SILVERY

STEEL PLANTS—60-pound Keokuk Electro-Silvery Pigs for blocking the open hearth heat. For equal distribution of silicon and best temperature melt-down. Handle by magnet.

FOUNDRIES—30-pound Keokuk Electro-Silvery Pigs for charging mechanically or by hand into the cupola. Easily broken into two or more pieces, handled by magnet and measured by weight. Regular or alloy analysis.

FOUNDRIES—12½-pound Keokuk Electro-Silvery Piglets so uniform in weight that they may be charged into the cupola by count, eliminating weighing operations. Handled by magnet. Regular or alloy analysis.

KEOKUK
electro-silvery

SALES AGENTS: Miller and Company, 332 S. Michigan Avenue, Chicago 4, Ill. Cincinnati 2, Ohio, 3504 Carew Tower • St. Louis 1, Missouri, 407 N. Eighth St.

PRODUCT OF KEOKUK ELECTRO-METALS COMPANY
KEOKUK, IOWA

CHAPTER ACTIVITIES

(Continued from Page 75)

Simpson, whose book on the subject has just been published, outlined the development of the castings industry from pre-historic times up to the early 20th Century. His talk was illustrated throughout with lantern slides showing stages of foundry development.

Preceding Mr. Simpson's talk, Robert Gregg, A.F.S. National Director, outlined his impressions gained on a recent foundry survey trip throughout Europe.

The speaker for the October meeting was announced as Clyde A. Sanders, American Colloid Co., Chicago, who will speak on "Foundry Sand Practice."

Birmingham District

J. P. McClendon
Stockham Pipe Fittings Co.
Chapter Reporter

A RED LETTER DAY in Chapter history was Saturday, September 11, when 750 foundrymen gathered at the Roebuck Country Club, Birmingham, for the chapter's 15th Annual Outing. It was the best outing ever sponsored by the Birmingham District chapter.

D. C. McMahen, Harbison-Walker Refractories Co., general chairman of the Outing, is to be commended for a job well done, as are J. R. Reynolds, Hill-Griffith Co., J. M. Bates, Moore-Handley Hardware Co., and Guy Bagley, Woodward Iron Co., who were in charge of ticket distribution.

William Bach, Foundry Service Co.; Gene Welchel, American Cast Iron Pipe Co.; and J. T. Gilbert, Stockham Pipe Fittings Co. arranged the sports program, which included golf, swimming, horseshoe pitching, a softball game and table games. In addition, there was plenty of room for relaxation under the tall pine trees of the Roebuck Country Club.

Dr. J. T. Mackenzie, American Cast Iron Pipe Co., chapter chairman; C. P. Caldwell, Caldwell Foundry & Machine Co., vice chairman; and F. K. Brown, Adams, Rowe & Norman, secretary, who were congratulated by the membership for the fine program and barbecue, in turn passed the credit on to the general chairman and his committee.

a new night gang for your foundry

JUNIOR
NITE-GANG

Here it is . . . A complete portable molding sand preparation unit! The Junior Nite-Gang provides magnetic separation, screening, aeration, and the elimination of hand shoveling . . . *all in one machine.*

The Junior Nite-Gang is the only really portable machine for the small foundry which eliminates tedious hand shoveling and provides magnetic separation, thorough screening and aeration of molding sand.

SEND COUPON FOR NEW BULLETIN!

Beardsley & Piper are manufacturers of the Sandslinger • Speedslinger Hydra-Slinger • Speedmuller • Mulbaro • Screenarator • Junior Nite-Gang Preparator • Champion Speed-Draw • Plate Feeders Turntables • Gyratory Screens

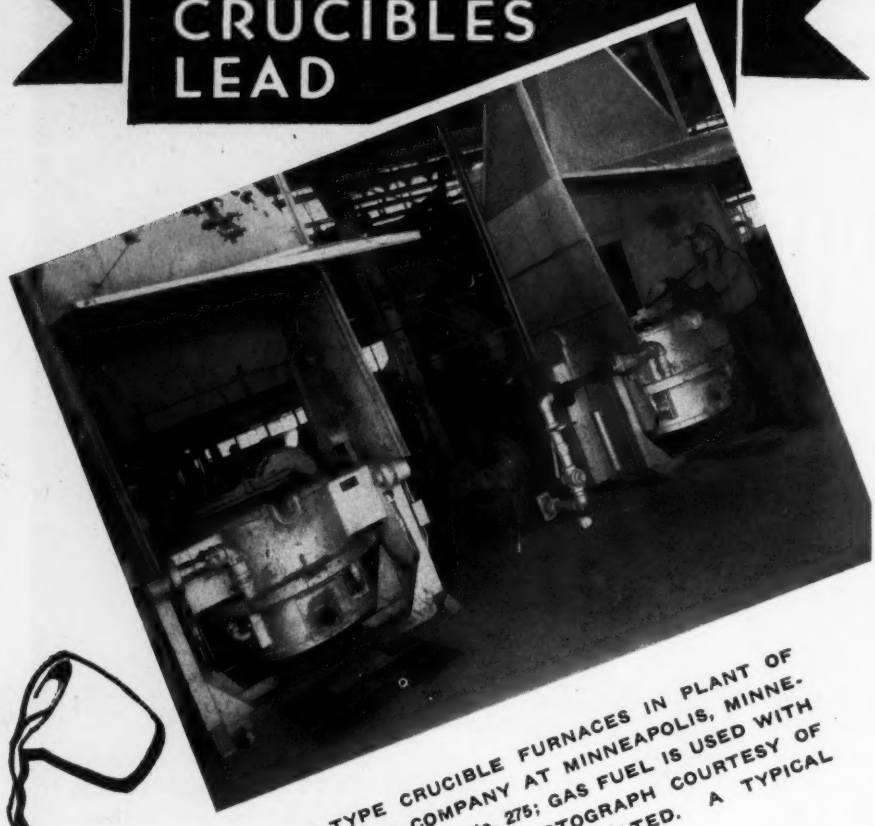
BEARDSLEY & PIPER
Division of Pettibone Mulliken Corp.
General Offices: 2424 North Cicero Avenue
Plant: 2541 North Keeler Avenue
Chicago 39, Illinois

☐ Send new Nite-Gang Bulletin.
☐ Where may I see Nite-Gang in operation?
☐ Have B&P representative call.

FOUNDRY _____
ATTENTION _____
TITLE _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

A

ON ALL COUNTS CRUCIBLES LEAD



TILTING-TYPE CRUCIBLE FURNACES IN PLANT OF NORTHERN PUMP COMPANY AT MINNEAPOLIS, MINNESOTA. CRUCIBLES SIZE No. 275; GAS FUEL IS USED WITH PROPORTIONAL MIXERS. PHOTOGRAPH COURTESY OF NORTHERN ORDNANCE INCORPORATED. A TYPICAL CRUCIBLE INSTALLATION.

A foundry operating with modern Crucible Melting equipment has these advantages:

1. Control of Quality
2. Moderate Investment Cost
3. Low Cost of Labor

Add up these three advantages and you have freedom from worry in non-ferrous melting seldom possible with any but the Crucible method.

There is more in **Crucible Melters' Handbook** about satisfaction to be gained. Ask for this book; mailed free.

CRUCIBLE MANUFACTURERS ASSOCIATION

140 Cedar Street, New York 6, N. Y.

PERSONALITIES

(Continued from Page 78)

district sales representative in Southern Illinois and Eastern Missouri. Born in Copenhagen, Denmark, Mr. Ramsen is a graduate of the Polytechnic Institute of Copenhagen and came to this country to drive for Arthur Chevrolet in the 500-mile Indianapolis race, after participating in many European long-distance road races.

Recent personnel changes announced by the Magnesium Division of Dow Chemical Co., Midland, Mich., are: **J. C. H. Stearns,** to be manager of ingot sales; **G. W. DeKuiper,** to be manager of wrought products sales; **T. H. Caldwell, Jr.,** to be manager of die casting sales; **Dr. J. C. McDonald,** to be manager of the technical service department. **E. H. Kilheffer** has been made Eastern manager for magnesium sales, with offices in New York; and **John White,** manager of magnesium sales in Boston.

E. H. Mebs, formerly division superintendent of foundries for the Johnstown-Lorain Works of the Carnegie-Illinois Steel Corp., has been appointed to the newly created position of works manager of the Machined Steel Casting Co., Alliance, Ohio.

Joseph W. Farley has been made manager of sales of machined steel castings for McConway & Torley Corp., Pittsburgh. Mr. Farley was formerly sales engineer with the Chester Electric Steel Co., Chester, Pa., the Fort Pitt Steel Castings Co., McKeesport, Pa., and the Lobdell Co., Wilmington, Del. Mr. Farley will head sales activities for McConway & Torley and its subsidiary, the Baltimore Foundry & Machine Co., Baltimore, Md.

George M. Hayes, formerly a member of the sales staff of the Foundry Service Co., Birmingham, and coordinator of the foundry division of the Veterans' Training Program at the University of Alabama, was recently appointed Southern territory sales engineer for Kerchner, Marshall & Co., Birmingham.

OBITUARIES

Charles Appel, for 44 years an employee of the Lunkenheimer Valve Co., Cincinnati, died May 6 enroute to his home from the 1948 A.F.S. Foundry Congress in Philadelphia. Mr. Appel succeeded to the head of the company's Pattern Department upon the death of his father, who held the same position for 42 years. A long-time member of the American Foundrymen's Society, Mr. Appel was pattern and foundry consultant to the Lunkenheimer Co. during recent years.

Carl A. Carlson, 60, sales engineer for the Norton Co., Worcester, Mass., died August 29 in an airplane crash near Winona, Minn. Born in Stockholm, Sweden, Mr. Carlson graduated from the Sala Engineering School in Sweden before coming to the United States in 1912, when

(Continued on Page 88)

HOW HIGH IS YOUR SANDPILE?
HOW LOW IS YOUR CRANE?

Here's a Blaw-Knox Single Line, Hook-On Type Bucket that needs only 6' 7" operating headroom! Perhaps one of the 4 sizes of this design will prove exactly what you need for efficient handling of moulders' sand, coke, slack coal or other loose bulk materials. You'll find it fully described in Catalog 2232, which will be forwarded immediately on request.

BLAW-KNOX DIVISION
OF BLAW-KNOX COMPANY
2073 FARMERS BANK BUILDING
PITTSBURGH 22, PA.

BLAW-KNOX *FOUNDRY* BUCKETS

order National BRAND

BENTONITE

highest FOUNDRY *quality*

Prompt shipment—unlimited quantities now available to foundries from BAROID—the world's largest producer of Bentonite. Our modern plants are geared to fulfill every requirement of the foundry trade.

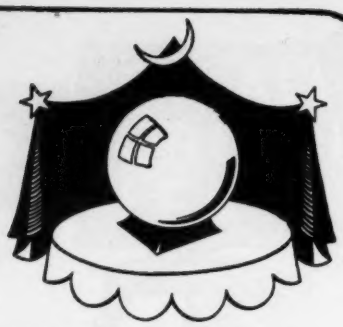
From THESE APPROVED DISTRIBUTORS

American Cyanamid Co.
New York, New York
The Asbury Graphite Mills, Inc.
Asbury, New Jersey
Barada & Page, Inc.
Kansas City, Missouri (main office)
Also—(Branches)
Tulsa, Okla.
Oklahoma City, Okla.
Wichita, Kansas
Dallas, Texas
Houston, Texas
New Orleans, La.
G. W. Bryant Core Sands, Inc.
McConnellsville, New York
Canadian Industries, Ltd.
Montreal, Quebec, Canada
(all branches)

Casco, S. de R.L.
Mexico, D. F.
The Foundries Materials Co.
Coldwater, Michigan
Also Detroit, Mich.
Foundry Service Co.
North Birmingham, Alabama
Foundry Supplies Co.
Chicago, Illinois
Thomas H. Gregg Company
Milwaukee, Wisconsin
Independent Foundry Supply Co.
Los Angeles, California
Industrial Foundry Supply Co.
San Francisco, California
Klein-Farris Co., Inc.
Boston, Massachusetts
LaGrand Industrial Supply Co.
Portland, Oregon

Marthens Company
Moline, Illinois
Carl F. Miller & Co.
Seattle, Washington
Pennsylvania Foundry Supply & Sand Co.
Philadelphia, Pennsylvania
Robbins & Bohr
Chattanooga, Tennessee
Smith-Sharpe Company
Minneapolis, Minnesota
Southwest Foundry Supply Co.
Houston, Texas
Mr. B. J. Steelman
Chicago, Illinois
Stoller Chemical Co.
Akron, Ohio
Wehenn Abrasive Co.
Chicago, Illinois
Mr. Walter A. Zeis
Webster Groves, Missouri

baroid SALES DIVISION • NATIONAL LEAD COMPANY
BENTONITE SALES OFFICE: RAILWAY EXCHANGE BUILDING, CHICAGO 4, ILL.



Predictable Castings

Most of the "guess" has been taken out of foundry work; cast iron has become predictable. Improvements are due to better control at all stages of foundry practice, and to the use of alloy irons.

Predictable Molybdenum high strength cast iron is used for engine cylinders, cylinder blocks, liners, brake drums and other castings where strength and toughness, together with good wear resistance and heat resistance, are paramount.

Molybdenum is a popular alloying element in high duty irons because of its positive and predictable improvements; the improvements far outbalance the additional cost.

Authoritative engineering data on Molybdenum cast iron and its applications are furnished by Climax Molybdenum Company.

Climax Molybdenum Company
500 Fifth Avenue · New York City

F.I.

OBITUARIES

(Continued from Page 86)

he began work in Norton's machine shop a year later. After a brief stay in France, where he helped organize Norton's Paris plant, Mr. Carlson became affiliated with the company's Sales Engineering Department, where he remained until the time of his death. A leading consultant on snagging operations, Mr. Carlson held patents on a billet grinding machine and a wire grinding machine and was author of many technical articles on abrasive grinding wheels. At the time of his death, Mr. Carlson was in the midst of a search for a product to replace South African corundum. Mr. Carlson had for years been a member of the American Foundrymen's Society and the New England Foundrymen's Association.

Colin R. Walcott, secretary-treasurer of the Newaygo Engineering Co., Newaygo, Mich., died at his home September 8.

Frank V. Horstman, 49, works manager of the American Brake Shoe Co.'s St. Louis Division since February 15 of this year, drowned in the Mississippi River July 22 while on a river excursion with fellow employees. He disappeared while swimming toward a sand bar and rescue efforts were unavailing. Mr. Horstman started with Brake Shoe as a molder in 1918, was appointed general foundry foreman in 1925 and assistant works manager in 1943. He is survived by his wife and a daughter.

Morrell M. Clark, 55, of Canton, Ohio, district representative for the Climax Molybdenum Co., died following a heart attack early last month. Mr. Clark served in various metallurgical and supervisory capacities with the United Alloy Corp., Canton; Mitchell Steel Co., Cincinnati; and the Carnegie-Illinois Steel Corp., Chicago, prior to becoming Canton District representative for Climax. Mr. Clark had long been active in the affairs of the A.F.S. Canton District Chapter.

Robert L. Cleland, 71, retired Eastern sales manager of Eastern Clay Products, Inc., died August 6 in Buffalo, N.Y. A pioneer in the development of synthetic sand practice, Mr. Cleland was for a long time associated with Whitehead Brothers.

Henry De Quaker, 45, foundry superintendent at Louis Meskan Brass Foundry, Inc., Chicago, drowned July 26 in Lake Thompson near Rhinelander, Wis. Three other passengers in the outboard motor boat were rescued. Mr. De Quaker is survived by his wife, Jeanette, a son, 11, and a daughter, 9.

Henry S. Binns, 58, chief of the metallurgical laboratory of the Cincinnati Milling Machine Co. for 20 years died recently in Cincinnati. A member of the American Foundrymen's Society and the Cincinnati Engineering Society, Mr. Binns had been chairman of the American Society for Metals in Cincinnati. He was an internationally-known authority on metallurgy.

PETERSON
VIBROLATOR
T. M. Reg.

"WORLD'S QUIETEST VIBRATOR"

- All Directional
- Dependable
- No Springs
- Long Life

Ask your favorite Foundry supply man for details on the new Peterson Holiner. This new development saves core boxes, blow plates and temper in core blowing operations.
The Peterson Core Blower is the latest thing in core machines. Biggest of the small machines, it is reasonably priced.

Write For More Details

MARTIN ENGINEERING COMPANY
KEWANEE, ILLINOIS

ANALYTICAL SERVICE

Chemical and Physical Tests of all Ferrous and Non-ferrous metals

ENGINEERING SERVICE

Consulting and Advisory Metallurgical and Foundry Engineering

METALLOGRAPHIC SERVICE

Photomicrographs, Grain Size, etc. on all Ferrous and Non-ferrous Metals

CHARLES C. KAWIN CO.
CHICAGO 5, ILLINOIS
431 S. Dearborn Street

BUFFALO 2, NEW YORK
110 Pearl Street

ABSTRACTS

Converter Practice

OXYGEN ENRICHED BLAST. J. L. Harrison, W. C. Newell, and A. Hartley, "The Application of Oxygen Enrichment to Side-Blown Converter Practice," *Journal of the Iron and Steel Institute*, vol. 159, part 3, July 1948, pp. 281-290.

The use of oxygen enrichment can be traced back to the earliest days of pneumatic steelmaking. Sir Henry Bessemer was aware of its potentialities when developing his converter process.

Recent interest was awakened by economic changes in the supply of raw materials and potential cheapening of tonnage oxygen. This led to its application not only to pneumatic furnaces but to open-hearth and electric furnaces either for improvement of thermal efficiency or for selective oxidation of carbon.

The broad objective of the authors was the desire to obtain more easily the high temperature necessary for steelmaking.

This can be expressed in terms of fuel economy for both carbon and silicon, not only in the converter but also in the preliminary iron-melting cupola, on account of the lower acceptable liquid-iron temperature. The objective can be expressed in terms of economy of pig iron and its increased replacement by steel scrap and not least by a saving of melting time and the potential increased furnace output and range of application of the converter process. The present investigation has verified and measured in a commercial steel foundry the practicability of this objective, and it has shown that in addition a closer control of composition is possible.

The side-blown converters used for the investigation were originally operated as stock converters.

Air is supplied to converters at a pressure of 3 to 3½ psi by a positive-displacement blower.

The cupola charge contained 20 per cent hematite iron and 80 per cent steel scrap with ferrosilicon.

Desulphurization was carried out in a basic stoppered-nozzle type ladle.

After completion of the blowing operation, slag was removed. Ferromanganese and ferrosilicon were added for purposes of deoxidation.

Oxygen was obtained from an evaporator and the oxygen equipment included a series of low-pressure tanks which were filled from the evaporator with a non-return valve. A pressure-reduction valve admitted a constant flow of oxygen into the air main.

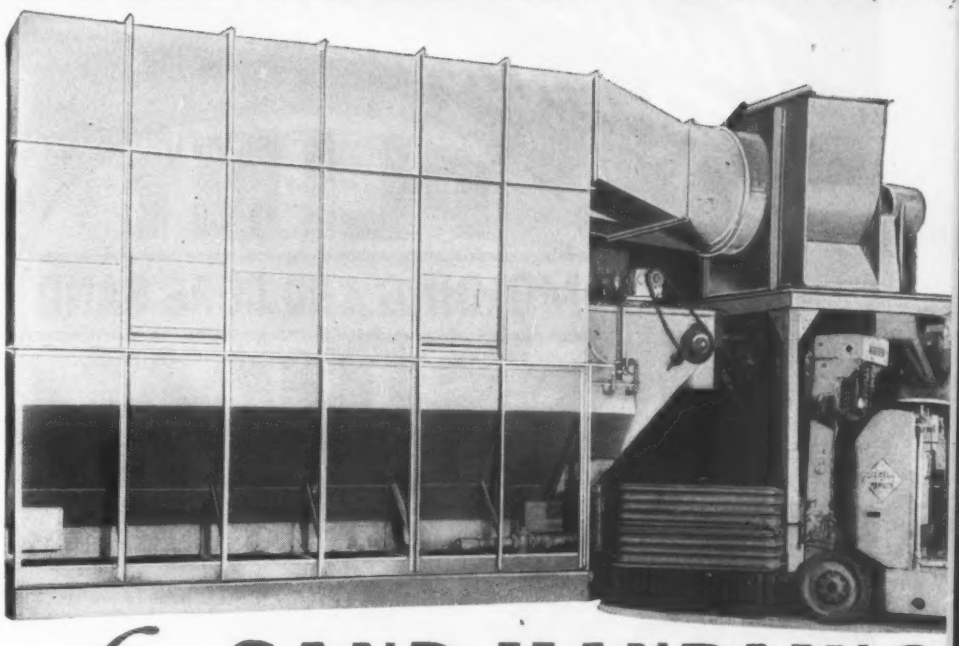
Blowing losses were reduced considerably when the quantity of oxygen was raised from 30 per cent to 50 per cent after 4 min blowing time.

There was no appreciable decrease in the average life of linings in the side-blown converter.

The reduction of nitrogen content leads to more efficient utilization of total oxygen.

From experience gained after several months the authors are of the opinion

Announcing
THE BEST INVESTMENT IN DIRT AND DUST CONTROL EQUIPMENT YOU CAN MAKE!
Schmieg NEW all Stainless Steel ARRESTER UNIT



for SAND HANDLING and SHAKEOUT

Because it is made of stainless steel and *because* it is designed and manufactured for longer, corrosion-free operation, the new Schmieg 30,000 C.F.M. Centri-Merge Swirl Type Arrester illustrated is the best buy on the market. Stainless steel is your guarantee of long-range low maintenance costs. A Schmieg unit is easily installed to occupy a minimum of valuable floor space for the most efficient removal of dust and dirt from shakeout stations, sand handling and conditioning systems. Sludge disposal is perfectly simple—you use nothing more than a skid on a lift truck. We urge you to consider carefully the *dollar-saving advantages* of an investment in a Schmieg stainless steel Arrester Unit.

Consult Schmieg engineers regarding your problems of dust and fume control.

THE best AIR PURGE is CENTRI-MERGE

Schmieg INDUSTRIES INC.
Engineers & Manufacturers
308 PIQUETTE AVENUE • DETROIT 2, MICHIGAN

OTTAWA SILICA CO. offers . . .

WASHED
DRIED
SCREENED
GRADED
WHITE SANDS

Our specially prepared SILICA SANDS are available in various sizes. We have the particular grade best suited for your requirements. ¶ You will find our SANDS most suitable for cores —they save oil—they are clean, uniform and constant in quality. ¶ SILICA FLOUR, at its best, for foundry uses.

OTTAWA SILICA COMPANY
Ottawa, Illinois

that the side-blown converter with oxygen enrichment is likely to be increasingly used, not only in foundries for carbon and manganese steels but also for bulk ingot production.

This last suggestion would probably necessitate modifications of design in the light of the altered aerodynamic conditions inside the converter.

Production Planning

DEPARTMENTAL COOPERATION. Jorgen Drachmann, "Some Fundamental Problems in Foundry Planning," *Foundry Trade Journal*, vol. 85, no. 1666, August 5, 1948, pp. 121-127.

The managing director and the sales department must first have their work planned so that internal relations as well as routines are not upset.

Two main technical principles of planning which must be followed in any attempt to make an effective planning system are: (1) the principle of total load; and (2) the principle of margin.

The first means that, whatever system be adopted, the total load of orders on each product must be taken into account somewhere in the system.

The second, that calculations for the future cannot be absolutely sure to agree with realities so that certain allowance has to be planned for unexpected circumstances, either on capacity when loading the departments or machine groups or on a percentage of security on delivery terms from the selling department.

When starting a planning department the first step is to obtain statistics on as many previous years' selling and production as possible, month after month, and to determine the total percentage delivered each month for each product. Care should be taken to ensure that the years taken are normal.

With this information the planning department can go to the sales department and ask about sales for the next year of production and production can be planned according to the salesman's statements.

The next step is to break down the components and divide the castings into production groups; groups of hand molders, coreshop, etc. and load them according to their piece rate.

A close cooperation between sales department, machine shop, and foundry planning department is essential.

If the sales department's estimate is incorrect the material has to be sold from stock. Available stock is then calculated for each key casting, listing: (1) castings in stock; (2) castings which should be available according to plan; and (3) castings reserved for existing orders.

If sold from stock a stock card has to be kept on which all movements of the quantity in stock are carefully entered. Besides the ordinary information, type of product, etc., the minimum stock requisition point and the quantity to be requisitioned when this point is reached are to be entered.

From a planning point of view a customer with jobbing orders should place them in appropriate quantities at the right time since estimates vary from the time the

quotation is made, order confirmed, and pattern shop and foundry have produced the castings.

A large foundry may have to cope with seasonal variations, sales forecasts, and jobbing orders. To manage and plan the operations requires the right man. If the foundry has been established and works rather well the planner may be recruited from the rate fixers since they know the paper routine, prices, and capacity of the individuals in the foundry. If it is just being started, personnel problems are added and a timestudy man might work in the planning department of another foundry for training.

The main point for the planner to hold to is the principle that all orders, whether for own production or of the jobbing variety, when they are accepted, confirmed, and a delivery date promised, must be treated alike.

Thermit Welding

COMPOSITE CAST-ROLLED STEEL ASSEMBLY. P. H. Setzler, "Welding Screw Shafts in Castings," *The Iron Age*, vol. 162, no. 9, August 26, 1948, pp. 93-94.

Thermit welding assembly for steel castings to screw shafts was adopted at United Welding Co., Middltown, O.

The screws are SAE 1040 hot rolled steel shafts 7 to 13 in. in diameter and are joined to high strength steel castings. The assembly is preheated prior to starting the thermit reaction.

The reaction starts at 1200 F and at completion the molten steel reaches a temperature of 5000 F. Extra heat and high temperature melt part of the parent metal causing fusion between it and the thermit metal. The weld analysis can be controlled during the process.

Savings in material and machining costs are considerable when the head is cast and thermit welded to a hot rolled shaft or forging. The weld mix is expensive but the average saving for each screw is $125.

Cast Iron

APPLICATIONS AND DESIGN. T. E. Eagan, "When and How To Use Cast Iron," *The Tool Engineer*, vol. 21, no. 2, August, 1948, pp. 17-20.

Gray iron, through modern metallurgy, has become a dependable engineering material that properly applied, will give outstanding performance. Gray iron can be broadly called steel plus graphite. This graphite, which occupies 11 to 17 per cent of the volume of the metal, largely controls the physical characteristics. Various strengths of gray iron can be produced by controlling both the distribution and the amount of graphite.

Gray iron may be used instead of steel for many applications. One is for cast crankshafts. Normally the stress concentration is too high but this can be almost completely eliminated by proper contouring. The new SR-4 strain gages aid this. Certain vibrations experienced in crankshafts in internal combustion engines require a metal with the excellent damping capacity possessed by gray iron.

Gray iron is the most castable of ferrous metals and its flowability requires small or no risers in the lower tensile strengths. It lends itself to more complicated designs than other cast metals—as shown in such examples as auto engine blocks and head.

Because of its excellent wearing qualities gray iron is used in practically all engine cylinders and lines.

Gray iron is resistant to corrosion. Most water mains were made of cast iron and remained in good condition for more than 100 years. In heads, cylinder liners, and engine blocks that are salt water cooled it has been used successfully for years.

Chemical analysis controls the physical properties. The only man in position to specify the proper analysis, for a given casting in which the desired physical properties are specified is the foundry metallurgist who must make his decision after he has seen the pattern or drawing, method of molding, and the gating. It is safer to let the foundry specify its analysis.

The same heat treatment as for steel can be used on gray irons; tensile strength can be doubled by heat treatment.

Complicated gray iron castings usually have a considerable amount of residual stress in them which can be removed safely by a stress-relief anneal. This is more economical than the aging method.

Gray iron can be hardened by quenching and drawing. Direct annealing processes can be used on gray iron to improve machineability but at a sacrifice of physical properties; such treatment should be avoided as unnecessary expense.

The casting design principles are the same as for steel. The section should be as uniform in thickness as possible with ample fillets in the corners. Any major change in section should be taper blended instead of filleted and the casting should have a regular parting line if possible. The design should be such that the casting will solidify progressively and have the simplest possible core set-up.

The designer should make up a rough design then consult a good foundryman before completing the work.

Continuous Casting

COPPER-BASE ALLOYS. J. S. Smart, Jr. and A. A. Smith, Jr., "Continuous Casting—The Asarco Process," *The Iron Age*, vol. 162, no. 9, August 26, 1948, pp. 72-80.

Continuous casting by the Asarco process was developed at the American Smelting and Refining Co. for the production of copper and copper-base alloys.

This process employs a reservoir furnace to supply molten metal to a mold. The design and arrangement are unique.

The mold or die is integrally connected to the bottom of the furnace and to the entire metal supply and is fed by simple gravity flow as the solidified shape is withdrawn. Thus the process is characterized by the absence of a free liquid surface within the mold which shapes the casting, the only free-surface being in the casting furnace. The Asarco process produces sections varying from 0.14 to 16 sq. in. thus it primarily supplements the size range of other methods.

The equipment is arranged on four levels as material flow is predominantly vertical. The charge is wheeled to the

You are invited to TEST the Uniform Quality of DAYTON CORE OIL

"Ask the men who use it."

Prove by use-test what hundreds of foundries know . . . that you get better cores at lower cost, and cleaner, more uniform castings, with Dayton Core Oil. Order a drum for a use-test. Ask our representative to help you solve your core production problems.

THE DAYTON OIL COMPANY
DAYTON, OHIO

Makers of DOCO BINDER & CORE PASTE • DOCO STEEL CORE & MOLD WASH

SILVERY

The choice of Foundries who demand the best.

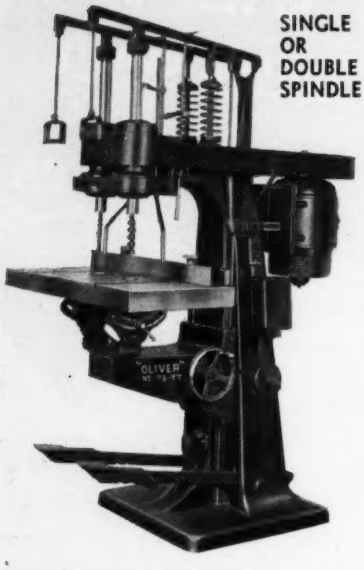
"Jisco" Silvery is a "must" in the modern foundry. Its use means better castings at lower cost. It supplies the needed silicon.

Full information upon request.

• VIRGIN ORES
• LADLE MIXED
• MACHINE CAST

THE JACKSON IRON & STEEL CO.
JACKSON, OHIO

"OLIVER" Vertical Borer



Bores holes up to 3" diameter, 12" deep to the center of 36"

An easy operating Borer for heavy work. Table is 18" x 30" with 17" vertical adjustment. Table tilts 40° to and from column, 15° to right and left. "Oliver" makes a complete line of woodworking machines for pattern shops. Write for details.

OLIVER MACHINERY COMPANY
GRAND RAPIDS 2, MICHIGAN

A New and Practical Book . . .

NONFERROUS MELTING PRACTICE

● . . . an Institute of Metals Division symposium, published by the American Institute of Mining and Metallurgical Engineers.

● Designed to cover the manufacturing and fabrication of the principal nonferrous metals — written for practical men by recognized authorities. Papers include:

Measurement and Control of Temperatures in Smelting, Refining and Melting Nonferrous Metals—by P. H. Dike and M. J. Bradley.
Melting of Brass and Bronze in the Foundry—by H. M. St. John. (With discussion.)
Melting and Alloying of Wrought Copper Alloys—by R. S. Pratt. (With discussion.)
Melting of Nickel—by W. A. Mudge. (With discussion.)
Melting and Refining Practices for Magnesium—by Charles E. Nelson. (With discussion.)
Melting of Aluminum—by T. W. Bossert and H. J. Rowe. (With discussion.)
Melting of Lead and Tin—by A. J. Phillips. (With discussion.)

Clothbound . . . 130 pages—AFS member price, $3.00 per copy; nonmembers of AFS, $3.50 per copy. Order your copy now from National Headquarters.

AMERICAN FOUNDRYMEN'S SOCIETY
222 West Adams Street
Chicago 6, Illinois

furnace and then chuted in by gravity.

All melting operations are in an indirect arc furnace with automatic hydraulic electrode feed and arranged for lip tilting. The rocking action of the furnace aids proper mixing of high leaded bronzes. When the charge reaches the proper temperature the entire melt is poured into the casting crucible via a launder connecting it to the furnace.

The mold construction permits maximum flexibility in use of large variety of die sizes and shapes in a standard series of jackets. Secondary jackets are available so that work will not come off the rolls at a temperature higher than 300 F.

The casting leaves the roll drive and enters the saw floor where it is cut to length by saws that travel with the work during the operation.

The work then drops to a tilting reservoir, then to tables on the ground floor for inspection.

The mold or die is the dominant factor in the process. It is machined from high density graphite and is used but once. Graphite is unusual in that its thermal conductivity is very high and it is neither attacked nor wet by molten copper-base alloys. It has excellent resistance to thermal shock and is self-lubricating and possesses outstanding machinability.

The physical properties and microstructures compare favorably with alloys cast by the permanent mold and sand cast methods. The rejection rate for casting defects after machining several million pounds of continuously cast bronzes is less than 0.1 per cent.

The continuous casting method has reached the commercial stage because of the ability of the process to produce all the products within its scope in the form of mill lengths. Fabricating mills can now procure basic castings in sizes and lengths best suited to their processing equipment.

Similarly, screw machine lengths are now available to machine shops in the foundry bronzes, bridging the gap between the economies of the automatic machining operations and the lack of suitable bronze shapes.

Centrifugal Casting

REVIEW OF PROCESSES. J. E. Hurst, "Centrifugal Casting; A Review of Present Knowledge," *Iron and Steel*, vol. 21, no. 9, August 1948, pp. 355-361.

During recent years the centrifugal casting process has been extended to general castings, not necessarily cylindrical, and to various alloys, including steels and non-ferrous alloys in addition to iron.

The newer centrifugal casting processes are distingushed from the simple form applied to plain centrifugal castings by classifying them as semi-centrifugal or profiled centrifugal and pressure centrifugal.

The semi-centrifugal castings are those not entirely formed by centrifugal forces as when cores are used. The cores may be metal or sand and the axes of rotation may be horizontal, vertical or inclined.

Pressure centrifugal casting refers to production methods of asymmetrical castings which cannot be spun about their own axes. Molds may be permanent or sand.

The greatest tonnage of centrifugal casting applications is in the production of cast iron spigot and socket pipe. Commercial processes in use are the deLavaud process utilizing a metal mold, referred to as metal spun; later processes using a sand mold are sand spun processes.

In the deLavaud process the water-cooled metal mold is mounted on friction rollers arranged on a bedplate and carriage in such a way as to be drawn over a pourer spout arrangement.

When the cavity is filled the mold is withdrawn at a uniform rate so that the combination of the rotary movement of the mold allows the metal stream to be deposited on mold surface as a continuous helix or spiral. For a given rotational speed the lead on the spiral is determined by the longitudinal movement and this can be regulated to ensure a complete cylindrical pipe. The rate of discharge of the metal from the tilting ladle for a given set of conditions is the factor that determines the pipe thickness.

Pipes cast by this process are annealed or normalized.

Sand molds are used in the sand spun process. Specially designed flasks are equipped with steel tires to enable the flasks to be rotated both during ramming up and the casting operation. Distribution of liquid metal over the whole mold surface takes place by centrifugal forces.

Solidification is slower in a sand mold than in a metal mold and rotation at speed is maintained until the casting has solidified. This slower solidification avoids the of chilled surfaces and produces castings having metallurgical characteristics of sand castings, therefore, they do not require an annealing or normalizing treatment.

In general the rotational speed depends upon the method and conditions of pouring, the nature of the mold, and the characteristics of the liquid metal.

In true centrifugal casting about a vertical axis, a substantial increase in the theoretical speed calculations to give a required internal form in bronzes has been found necessary.

The difference in speed requirements consequent upon the use of metal molds as opposed to sand molds in rotation about the horizontal axis has been observed. Attention has been drawn to the interconnection between the pouring conditions in so far as velocity rate and direction are concerned, and speed of rotation. In general, lower speeds of rotation are used. In these cases the characteristics of the mold are of considerable importance in determining the maximum speed that can be adopted with safety.

Cupola Fundamentals

THEORY OF CUPOLA OPERATION. C. C. Wright, "Some Factors Influencing the Performance of Cupola Fuels," *The Iron Age*, vol. 162, no. 7, August 12, 1948, pp. 72-77.

Among the important variables influencing the results of fuel combustion in a cupola are: chemical composition, size and reactivity of the fuel, the physical makeup of the bed and the charges, and the velocity and humidity of the air.

The four major chemical reactions between fuel and the reactive constituents present in gases in their probable order of importance are discussed individually from the viewpoint of their influence upon cupola operation and performance.

In the idealized case the blast is introduced uniformly across the cupola at tuyere level and the entering air is free from moisture vapor.

The distance above the tuyeres at which fuel bed temperature is reduced to approximately 2150 F, the melting range of iron, will be a function of the blast rate and of the reactivity of the fuel. This distance is of considerable importance to cupola operation, as it is the height at which the bed should be built and maintained. The distance between this zone and the tuyere level is that in which the metal to be cast is superheated above melting temperature.

The reduction and superheating zones may be lengthened by increasing the blast rate and thus reducing the time of contact; by increasing the size of the fuel and by decreasing the surface area per unit of carbon; or by using a fuel having a lower reactivity in the temperature range from 2150 F to 3000 F. It may be shortened by reducing the blast rate, by decreasing the size of the fuel, by increasing the reactivity of the fuel, or by permitting the introduction of quantities of water vapor in the air blast.

A number of physical factors also influence cupola performance. Among these blast penetration is of primary importance. Since the blast in a cupola is introduced through tuyeres or ports in the wall the size of the fuel selected for a given cupola should be at least 1/14 the diameter of that cupola. If a smaller size fuel is used, the oxygen will not penetrate to the center of the cupola and a lower temperature reduction zone at the center of the bed will result. The molten iron passing through the center section will then require less superheat and will lower the average temperature of the metal.

Fuel bed resistance is also an important factor in cupola operation. Poor quality fuels that break down appreciably in size due to thermal or mechanical shock also produce increased fuel bed resistance which may result in pressure problems.

For a given size and type of fuel, the fuel bed resistance is approximately proportional to the square of the gas velocity through the bed, which for a given cupola is also proportional to the blast volume.

Definite relationships exist between melting rate, metal temperature, blast rate and the metal to the fuel ratios for any given set of conditions.

In addition to the function of fuel as a source of heat, carbon and sulphur from the fuel enter into the metallurgical reactions, and similarly, the minor elements present in the metal charge enter into the combustion reactions.

Steel Casting Process

CONTINUOUS CASTING. T. W. Lippert, "Continuous Casting of Semi-finished Steel." *The Iron Age*, vol. 162, no. 8, August

Practical

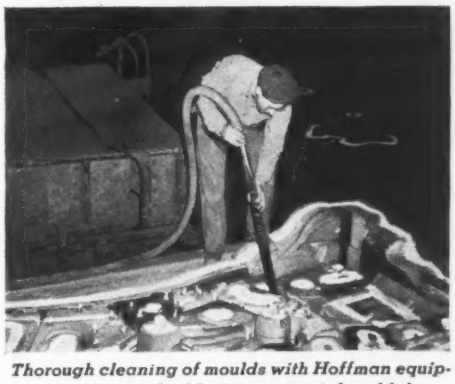
SEMET-SOLVAY metallurgists are practical foundrymen who are always glad to help with your melting problems. Their services go along with the use of Semet-Solvay Foundry Coke.

SEMET-SOLVAY DIVISION
Allied Chemical & Dye Corporation
CINCINNATI · DETROIT · BUFFALO
In Canada: SEMET-SOLVAY COMPANY, LTD., TORONTO

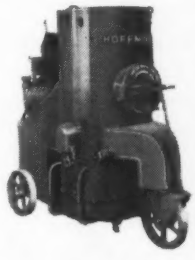
SEMET-SOLVAY FOUNDRY COKE

for Better Melting

This Foundry CUT COSTS with HOFFMAN heavy duty vacuum cleaning



Thorough cleaning of moulds with Hoffman equipment saves valuable time, material and labor



Modernize with Hoffman super-duty vacuum cleaning and get these big savings. Moulds and castings cleaned in less time — expensive material salvaged — waste of compressed air and hazard of blowing dust *eliminated*. Also, savings on light and painting — fewer cut-eye cases.

Hoffman equipment removes dust from walls, beams, piping, ledges as well as from floors, gangways, pattern storage, bins, etc. Available in 4 sizes of portable machines... stationary systems to fit your needs.

LET US SEND YOU LITERATURE AND DETAILS

U. S. HOFFMAN MACHINERY CORPORATION
AIR APPLIANCE DIVISION, 99 FOURTH AVE., NEW YORK 3, N.Y.

Buehler

Offers a Complete Line of Equipment for the . . . METALLURGICAL LABORATORY

Buehler specimen preparation equipment is designed especially for the metallurgist, and is built with a high degree of precision and accuracy for the fast production of the finest quality of metallurgical specimens.

1. No. 1315 Press for the rapid moulding of specimen mounts, either bakelite or transparent plastic. Heating element can be raised and cooling blocks swung into position without releasing pressure on the mold.

2. No. 1211 Wet power grinder with ¾" hp. ball bearing motor totally enclosed. Has two 12" wheels mounted on metal plates for coarse and medium grinding.

3. No. 1000 Cut-off machine is a heavy duty cutter for stock up to 3½". Powered with a 3 hp. totally enclosed motor with cut-off wheel, 12" x 3/32" x 1-1/4".

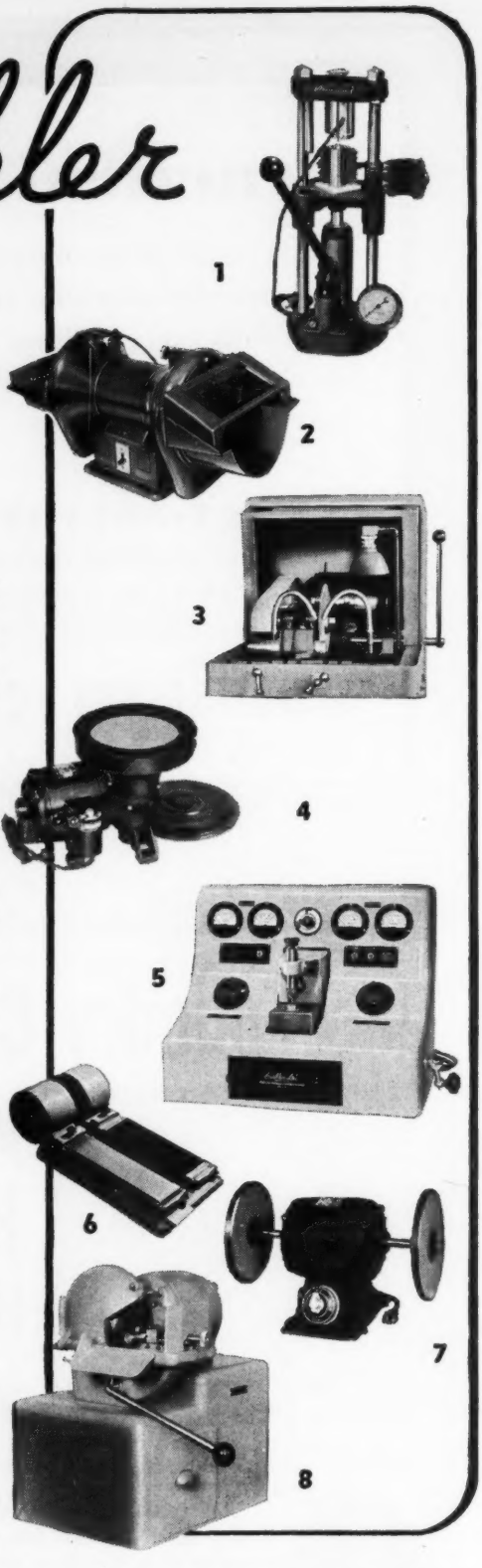
4. 1505-2AB Low Speed Polisher complete with 8" balanced bronze polishing disc. Mounted to ¼ hp. ball bearing, two speed motor, with right angle gear reduction for 161 and 246 R.P.M. spindle speeds.

5. No. 1700 New Buehler-Waisman Electro Polisher produces scratch-free specimens in a fraction of the time usually required for polishing. Speed with dependable results is obtained with both ferrous and non-ferrous samples. Simple to operate—does not require an expert technician to produce good specimens.

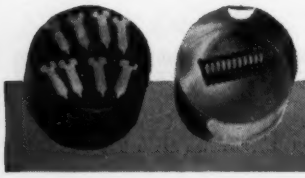
6. No 1410 Hand Grinder conveniently arranged for two stage grinding with medium and fine emery paper on twin grinding surfaces. A reserve supply of 150 ft. of abrasive paper is contained in rolls and can be quickly drawn into position for use.

7. No. 1400 Emery paper disc grinder. Four grades of abrasive paper are provided for grinding on the four sides of discs, 8" in diameter. Motor 1/3 hp. with two speeds, 575 and 1150 R.P.M.

8. No. 1015 Cut-off machine for table mounting with separate unit recirculating cooling system No. 1016. Motor 1 hp. with capacity for cutting 1" stock.



The Buehler Line of Specimen Preparation Equipment includes . . . Cut-off Machines • Specimen Mount Presses • Power Grinders • Emery Paper Grinders • Hand Grinders • Belt Surfacers • Mechanical and Electro Polishers • Polishing Cloths • Polishing Abrasives.



Buehler Ltd.

A PARTNERSHIP

METALLURGICAL APPARATUS

165 WEST WACKER DRIVE, CHICAGO 1, ILLINOIS

19, 1948, pages 72-80, and pages 159-161.

Republic Steel Corp. initiated a development program under the Williams patents, then entered into formal agreement with Babcock & Wilcox Tube Co. They carried on experimental work with casting of commercial sections at Beaver Falls, Pa.

Economics of the new process are based on the fact that smaller population areas consume small section products in the immediate locality. The scrap generated there is normally sufficient to sustain operations in the same plant. The massive and expensive parts (equipment for ingots, soaking pits, blooming mills) are not necessary in this process.

In continuous casting the metal passes directly from the melt to relatively small size unfinished sections. The costs for a given output, maintenance and operations are reduced very considerably.

The melt shop is similar to any modern melt shop as far as scrap handling and furnace facilities are concerned. A connecting building higher than the melt shop houses two inexpensive casting units operating separately in order to facilitate quick size changes and to permit maximum utilization of personnel. Capacity will consist of two 15-ton arc furnaces operating on a staggered two-hour cycle (tap to tap) when making ordinary varieties of carbon steel.

The melted charge will be delivered to three 5-ton containers used as ladles in taking metal up to the casting floor at the top of the tower. Holding and the pouring stations will be connected with heating power so that output of one of the arc furnaces can be taken out at one time and casting sequence can run independently.

Production from the casting unit will be delivered in cut lengths either to a cooling bed or to a reheating furnace for conventional mills.

The mold is the chief center of interest in casting. The material should have high heat conductivity and the liquid steel must show a negative meniscus. Lubrication of the mold is no longer considered advantageous as it tends to make porous areas in the casting.

The metal must be carried through the freezing stages more rapidly as the casting rate rises. To increase the cooling capacity of the mold surface for this purpose two steps are necessary: (1) increase heat conductivity of mold material, and (2) increase effectiveness of application of the coolant.

Slag volume influences the quality of continuously cast steel. To exclude slag the steel is poured into a tundish, thence into the mold. This cuts down velocity. The slower the flow of metal the better the slag is eliminated. An electrically heated tundish has been designed specifically for this reason.

A sound ingot is produced when steel in the mold solidifies progressively from the bottom to the top. This is accomplished more ideally in continuous casting by applying regulated cooling below the mold while the section has a liquid core. It is cooled much faster than in conventional ingots, the result being a fine, uniform crystalline structure and very little segregation.

BOOK REVIEWS

Commodity Specifications

National Directory of Commodity Specifications. National Bureau of Standards, Miscellaneous Publication, M178. Price $4.00. Superintendent of Documents, U. S. Govt. Print. Off., Washington 25, D.C. Supplement, 1947, $2.25.

All standards and specifications in general use for commodities produced or purchased in this country have been published in *National Directory of Commodity Specifications.* All types of products have been briefed, cataloged, and indexed in the Directory.

Because the Federal Government is the largest single purchaser of consumer goods, the Federal Specifications Board was established with the duty of compiling and adopting standard specifications conforming to the best commercial practice. This Board is made up of qualified representatives from the various branches of the Government. Each of the specifications has been formulated by one of its committees, then submitted to Governmental agencies, and engineering and technical societies for comment and criticism. The results have been summarized, classified, and indexed in the Directory.

The 1945 revision has had a Supplement issued in 1947 which includes new commodities available after the war.

The two volumes provide a complete listing by name, designating number, and issuing or sponsoring organization of all the standards, specifications, and methods of test in general use in this country. *"Simplified Practice Recommendations,"* and *"Commercial Standards"* are also included in the Directory.

Molybdenum

Molybdenum: Steels, Irons, Alloys, by R. S. Archer, J. Z. Briggs, C. M. Loeb, Jr. vi, 391 pp. Gratis. Climax Molybdenum Co., N.Y., published 1948.

Two earlier books *Molybdenum in Steel* and *Molybdenum in Cast Iron* have been combined with an added section on alloys to form a revised edition. The new book contains 500 references from world technical literature, 187 diagrams and charts, and 91 tables.

Molybdenum affects cast steel in many ways, but most particularly its hardenability, according to the new volume. Composition can be adjusted closely to the requirements of each casting; the metal is often alloyed in small batches. Unlike many other metals molybdenum is not lost by oxidation so that its content can be controlled accurately. Molybdenum is not a deoxidizer, therefore it does not form non-metallic inclusions.

This book explains that the advantages of molybdenum in cast iron are in proportion to the quality of the iron used. Since it is neither a graphitizer nor a strong carbide stabilizer, molybdenum can be added to all classes of cast iron without changing the character of the charge, the normal melting practice, or the base composition.

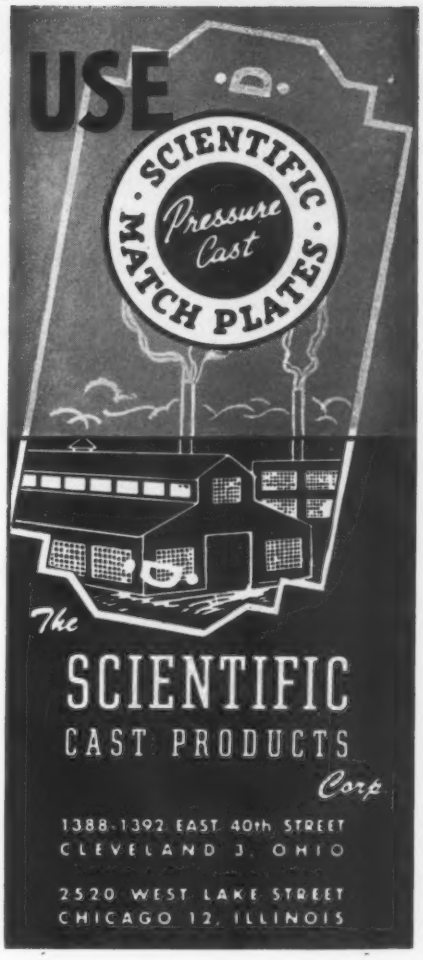
The technical effects of molybdenum are discussed as they affect steel, cast steel and cast iron, in Section I. In Section II, the fundamental effects of heat treatment on microstructure are noted and explained in the book.

Section III, on additions of molybdenum, reports that recovery of the molybdenum from scrap is almost complete, therefore it is of considerable economic importance. It does not oxidize from the bath as other hardening elements so hardenability is easily controlled. This results in further economy of the melting and casting process.

Other sections of *Molybdenum: Steels, Irons, Alloys* go into great detail on the use and effects of molybdenum in cast steels, gray iron, white iron, and malleable iron.

Wrought steels containing molybdenum are covered in several sections on alloy engineering steels, corrosion resistant steels, and steels for elevated temperature service. Special purpose alloys and nonferrous alloys are also described.

The book includes appendices on chemical composition ranges for alloy engineering steels used in America, in Great Britain, and in France, as well as on the physical properties of metallic molybdenum.



Just Published

COPPER

As an Alloying Element in Steel and Cast Iron

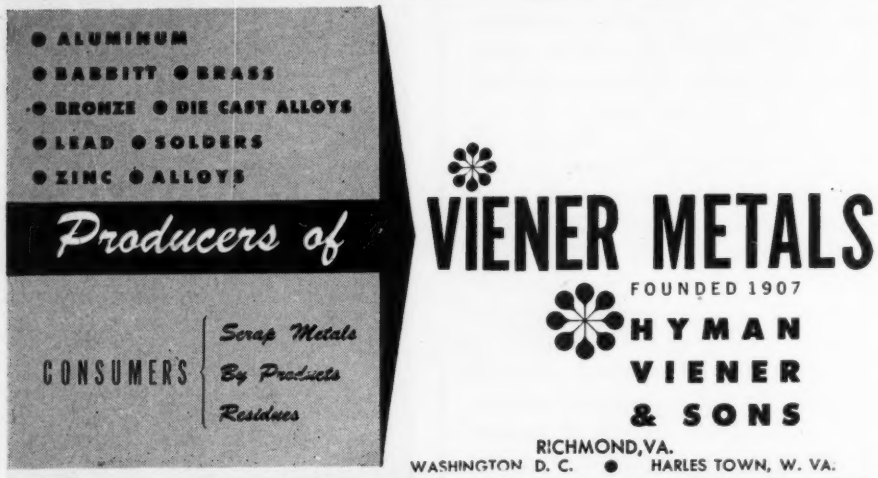
By Dr. C. H. Lorig, B.S., M.S., Ph.D.
Assistant Director, Battelle Memorial Institute

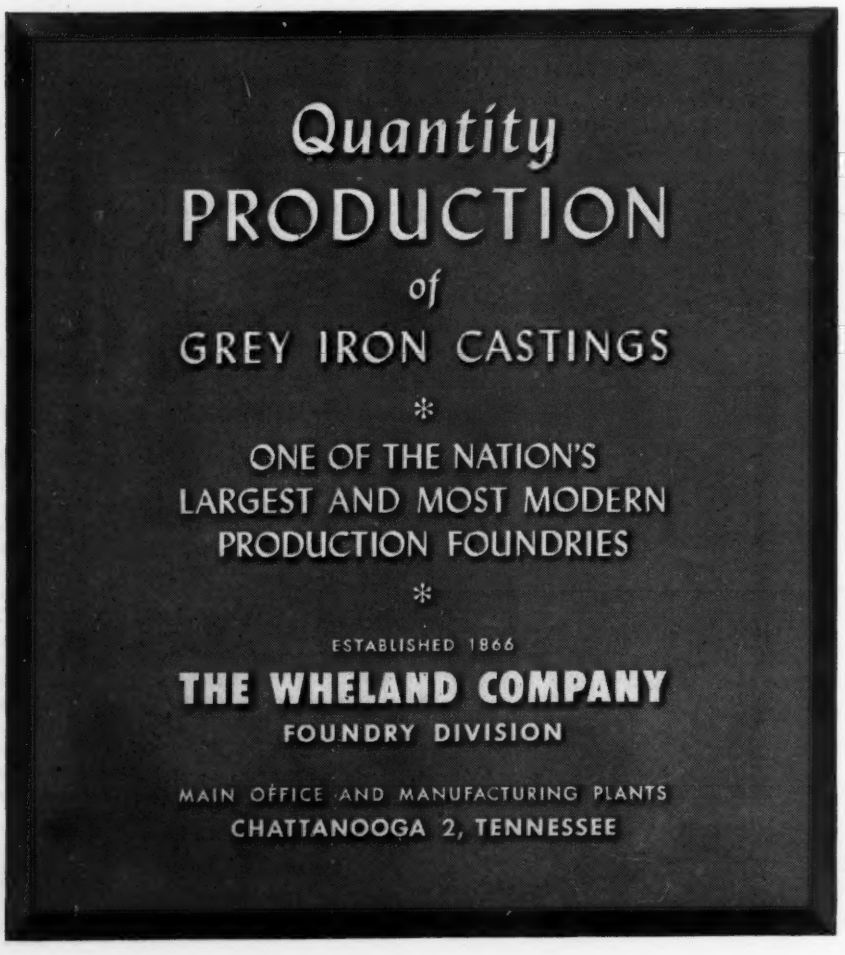
and R. R. Adams, B.S., M.S.
Research Metallurgist, Battelle Memorial Institute

206 *pages*, 90 *tables and graphs*, $3.00

Here is a concise discussion of the techniques of employing copper as an alloying element in cast and wrought steel and iron. It includes a correlated treatment of the influences of copper in promoting the hardenability of steel . . . in raising the ratio of yield to tensile strength and other mechanical properties of various steel products . . . and in replacing a large portion of the silicon content in cast iron to improve wear resistance, machinability, scaling, and corrosion resistance. Covered thoroughly are the known characteristics of cast copper steels, wrought copper steels, copper cast iron, and copper malleable iron, including a representative list of the uses of each of these materials in various industries.

Order from
American Foundrymen's Society
222 W. Adams St.
Chicago 6, Ill.





Index to Advertisers

Ajax Metal Co.	20
Alter Co.	96
Baroid Sales Div., National Lead Co.	87
Beardsley & Piper Co.	85
Blaw-Knox Co.	87
Buehler Ltd.	94
City Pattern Foundry & Machine Co.	11
Cleveland Flux Co.	19
Climax Molybdenum Co.	88
Crucible Manufacturers Association	86
Dayton Oil Co.	91
Delta Oil Products Co.	18
Eastman Kodak Co.	83
Electro Metallurgical Sales Corp.	12
Engineering Service, Inc.	97
Federal Foundry Supply Co.	1
Federated Metals Div., American Smelting & Refining Co.	10
Fisher Furnaces, Div. Lindberg Engineering Co.	4
E. F. Houghton & Co.	13
Industrial Equipment Co.	97
International Nickel Co.	7
Jackson Iron & Steel Co.	91
Kawin, Chas. C., Co.	88
Keokuk Electro-Metals Co.	82
Kirk & Blum Mfg. Co.	9
Knight, Lester B., & Associates, Inc.	6
Krause, Chas. A., Milling Co.	16
Martin Engineering Co.	88
Milwaukee Foundry Equipment Co.	21
Modern Equipment Co.	Cover IV
Oliver Machinery Co.	92
Ottawa Silica Co.	90
Peninsular Grinding Wheel Co.	14-15
Penola, Inc.	22
Pittsburgh Lectromelt Furnace Corp.	Cover II
Pyro Refractories Co.	98
Schmieg Industries, Inc.	89
Schneible, Claude B., Co.	2
Scientific Cast Products Corp.	95
Semet-Solvay Div., Allied Chemical & Dye Corp.	93
Smith, Werner G., Co.	Cover III
Stevens, Frederic B., Inc.	8
Union Carbide & Carbon Corp.	12
U. S. Hoffman Machinery Corp.	93
U. S. Reduction Co.	17
Velsicol Corp.	5
Viener, Hyman & Sons	96
Wheland Co.	96

FIRM FACTS

National Malleable & Steel Castings Co.'s recent $1500 "Safety Sweepstakes" fell short of its goal of 90 days without a lost-time accident by only five days. Rules of the Sweepstakes stipulated that if there were no lost-time accidents during the period, i.e., accidents as a result of which the employee failed to report for work the next scheduled working day, employees of the plant would be eligible to have their names drawn in a $1500 prize lottery. Unfortunately, a lost-time accident occurred on the 85th day of the Sweepstakes, automatically ending the contest period. However, according to plant officials, a new contest began immediately, and it is hoped that the 90-day term will be successfully completed this time.

Lebanon Steel Foundry, Lebanon, Pa., has acquired exclusive American rights to Firth-Vickers Stainless Steels, Ltd.'s techniques of permanent mold centrifugal casting, to be used in making turbojet components for the United States $500 million military aircraft program. The long-secret British process has definite promise of adaptability to a variety of new industrial uses, particularly those in which highly exacting requirements of exceptional heat resistance and corrosion resistant service must be met. The Firth-Vickers process has proved superior and more economical in the production of circular engine components than the usual method of forging or hollow rolling.

Sperry Products, Inc., announces the removal of its main plant and home offices from Hoboken, N.J., to Danbury, Conn., effective August 20.

Elmira Foundry Co., Inc., has been dissolved as a corporation upon becoming an integral part of General Electric Co.'s Apparatus Department, of which it was formerly an affiliate.

Sonith Industries, Inc., is the new name of **Indianapolis Brass & Aluminum Foundry, Inc.,** effective August 14. The name change was made because the former title did not includes the company's gray iron producing activities. On October 1, the company began the production of Meehanite castings.

Littite Foundries, Inc., is the firm title by which the **Little Brothers Foundry Co.** will henceforth be known. The management and policies will remain the same, and the company will continue to be located at Port Huron, Mich.

A new production unit of **Federated Metals Division** of the American Smelting & Refining Co. is now in operation at the Houston, Texas, plant. The new facility there is manufacturing solders, bearing metals, battery metals, lead ingot, type metals and special white metal alloys.

LADLES

LADLES • BOWLS • SHANKS • SPECIAL EQUIPMENT • TONGS • BAILS

• ALL CAPACITIES
• ALL TYPES *Including*
TIMKEN WORM GEARED LADLES

Catalog Available

Industrial EQUIPMENT COMPANY
115 N. OHIO ST. • MINSTER 1, OHIO

Facts...

- ABOUT INCREASED PRODUCTION
- REDUCED COSTS
- IMPROVED WORKING CONDITIONS
- REDUCED SCRAP
- MODERNIZATION &
- MECHANIZATION IN YOUR FOUNDRY

REALLY MEANS DOLLARS AND CENTS TO YOU

We can supply those facts. We specialize in foundry problems with reference to:

1. COMPLETE FOUNDRY SURVEYS
2. FOUNDRY CONSULTING & DESIGNING
3. ENGINEERED FOUNDRY SYSTEMS

We have applied our services successfully to gray iron, brass, steel malleable, aluminum and magnesium foundries. Write for new illustrated Bulletin "A."

Engineering service, inc.
610 W. Michigan St., Milwaukee 3, Wisconsin
Phone MArquette 0673.

USE

RELIABLE FOUNDRY REFRACTORIES

- *PYROREX*
- *PYRO SAVAGE*
- *OKILO*

CUPOLA BLOCKS
TAP HOLE BRICK
SLAG HOLE BRICK
CUPOLA SPOUT BRICK
STANDARD 9" BRICK
LADLE SKIMMERS
LADLE COVERS
LADLE SOLID BOTTOMS
LADLE LINERS
BRASS FURNACE SHAPES
PLASTIC REFRACTORIES
FOUNDRY FIRE CLAY
CUPOLA BLOCK MORTAR

The Pyro Refractories Co.

Oak Hill, Ohio

Cast Metals Handbook

List Price $6; $4 to A.F.S. Members . . .

Order a Copy Today

The Accepted Standard Reference Book for All CAST METALS

The complete, accurate and up-to-date reference book on the Engineering Properties of ALL Cast Metals should be among the technical books in every Foundry. Outstanding metallurgists and competent men of industry contributed to it. Committees of technical men helped compile it, from the engineering standpoint.

Separate sections deal with all the Cast Metals and include extensive data on engineering properties, specific applications, factors in good castings design, and many other factors essential to a knowledge of the design production and performance of metal products.

For post-war products, the Cast Metals Handbook is a dependable reference work of interest to foundrymen, engineers, and all those interested in the development of better metal products.

3rd edition, completely revised. Cloth bound, 745 pages, 258 illustrations, 204 tables, extensive bibliographies and cross-index.

American Foundrymen's Society

222 West Adams Street — Chicago 6, Illinois